Visual Analogue Scales

Brian Tiplady

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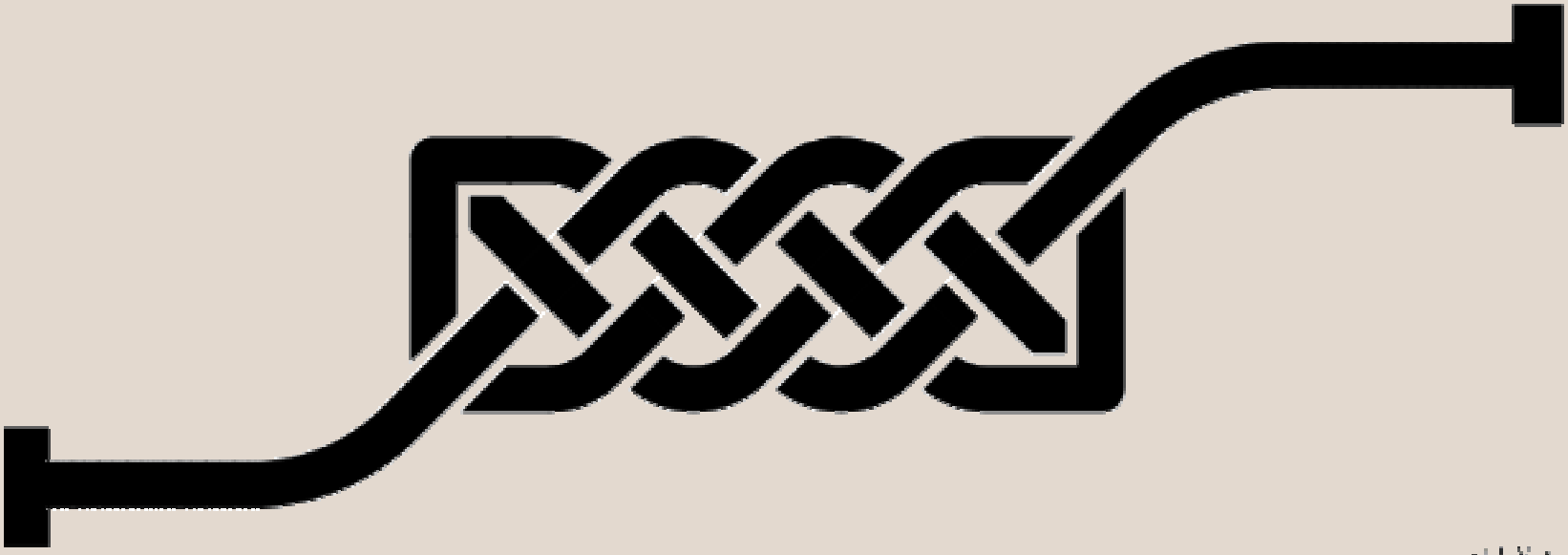


PRO Consulting®
Refining Patient Reported Outcomes

Visual Analogue Scale (VAS)

Visual Analogue Scale (VAS)

VAS - Bipolar

VAS - Unipolar

Drowsy

Not at all Extremely

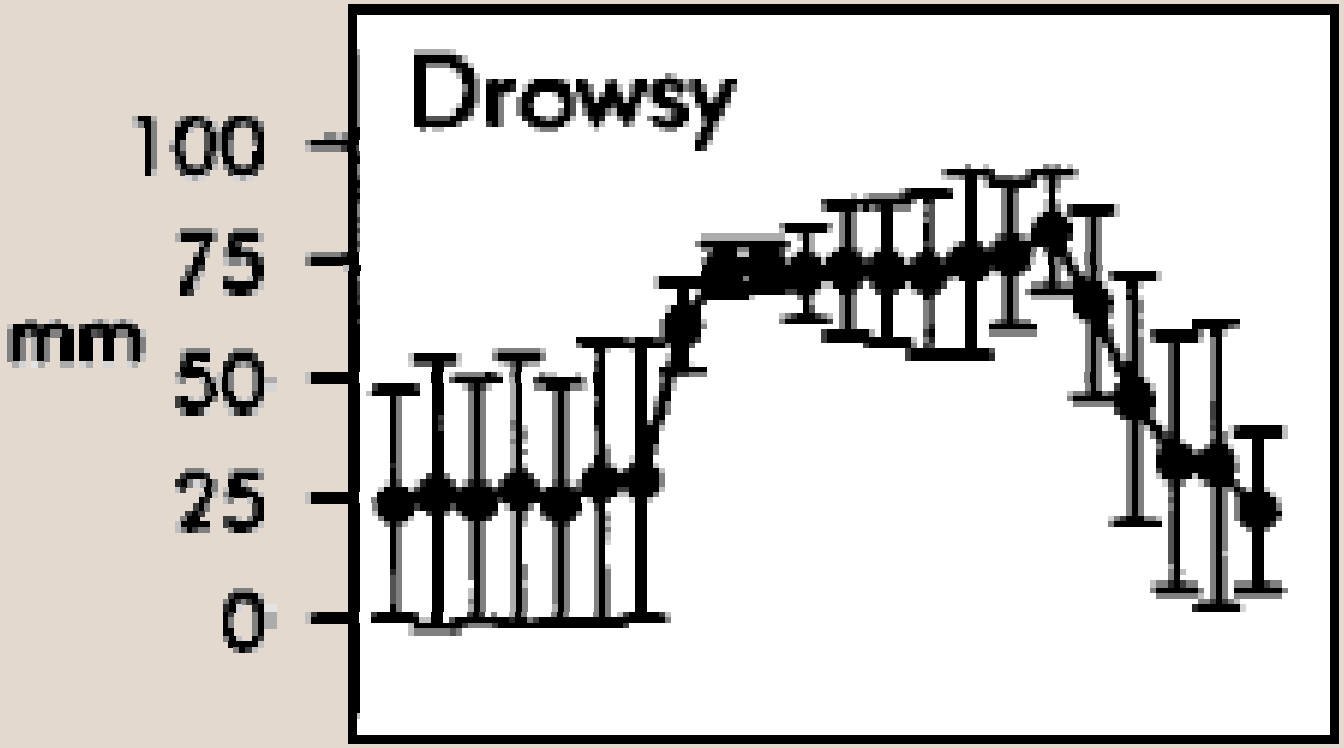
VAS - Scoring

Drowsy

Score is distance in mm from left pole, i.e % of scale length

VAS is thus a 101-point rating scale

Effects of i.v. Chlormethiazole

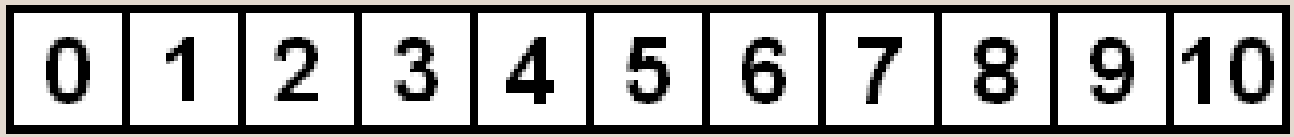


Assessments are at 7 minute intervals

Numeric Rating Scale (NRS)

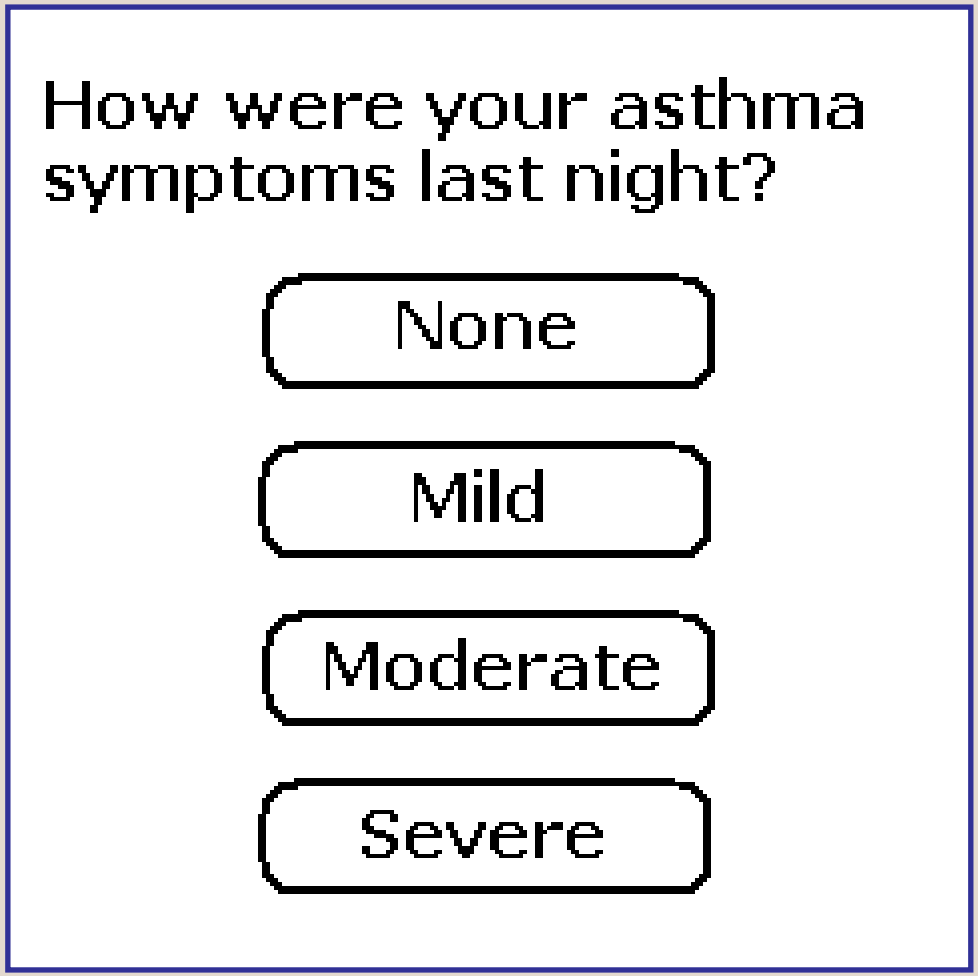
No Pain

Worst possible pain



NRS are most often 11-point scales

Verbal Rating Scale



Verbal rating scales generally have between 4 and 7 points

EuroQOL

Best imaginable health state

Worst imaginable health state

Types of Rating

- Pain
  - Single VAS for intensity
  - Multi-item scales, e.g. WOMAC
- Specific symptoms
  - Fatigue
  - Dizziness
- Mood and Arousal
  - Bond and Lader (1974): 16 scales

Types of Rating (Contd.)

- Hunger, desire to eat
  - Hill and Blundell (1982)
  - Flint et al. (2000)
- Craving (drugs, alcohol, tobacco)
  - Singleton et al. (2003)
  - Mendelson et al. (2005)
- Sleep quality
  - Leeds Sleep Evaluation Questionnaire

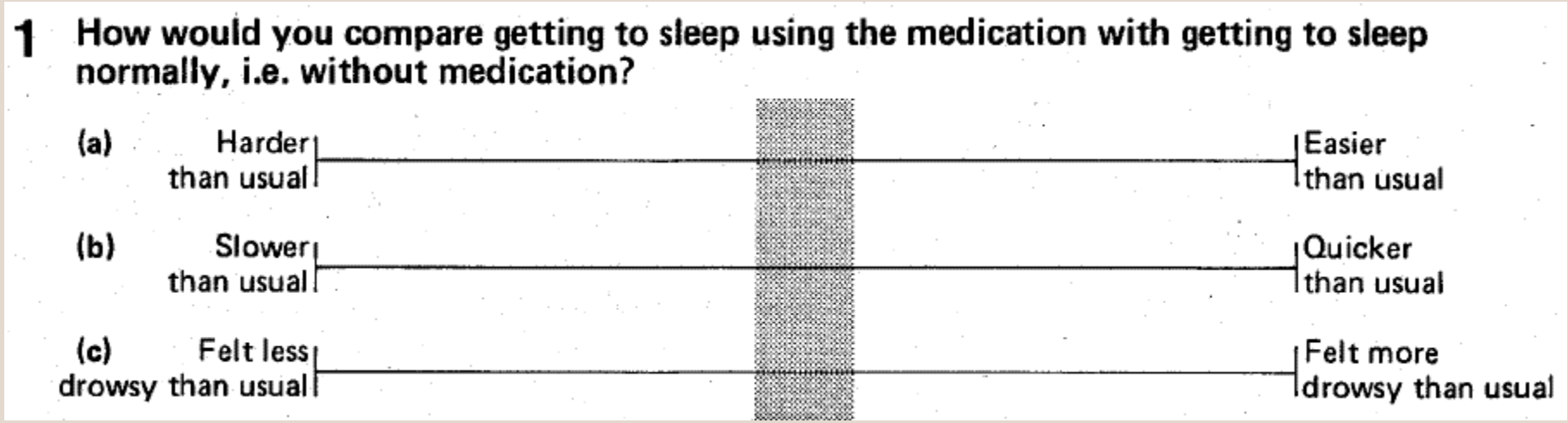
Advantages of VAS

- Simple and easy to use
- Finer resolution may allow greater precision and sensitivity than scales with fewer response categories
- Better scaling properties: ratio measure

Ease of Use

- Scale itself is simple
- Task of converting subjective state to a position on a line may not be quite so simple…

Ease of Use?



- Central area representing normality makes scale more complex
- “Usual” state is problematic, especially if sleep problems are of long duration

Leeds Sleep Evaluation Questionnaire

Ease of Use

- Reports in literature suggest that some older patients may have problems with VAS (see e.g. Kremer et al.,1981; Gagliese et al., 2005)

Use of VAS by Older Patients

Validation study used rating of external rather than internal magnitudes (Tiplady et al.1998)

- 50 younger subjects (17 men, 21-45, years)
- 50 older subjects (22 men, 60-82 years)
- Ratings of four animals on three scales:

Crow

Tiger

Tortoise

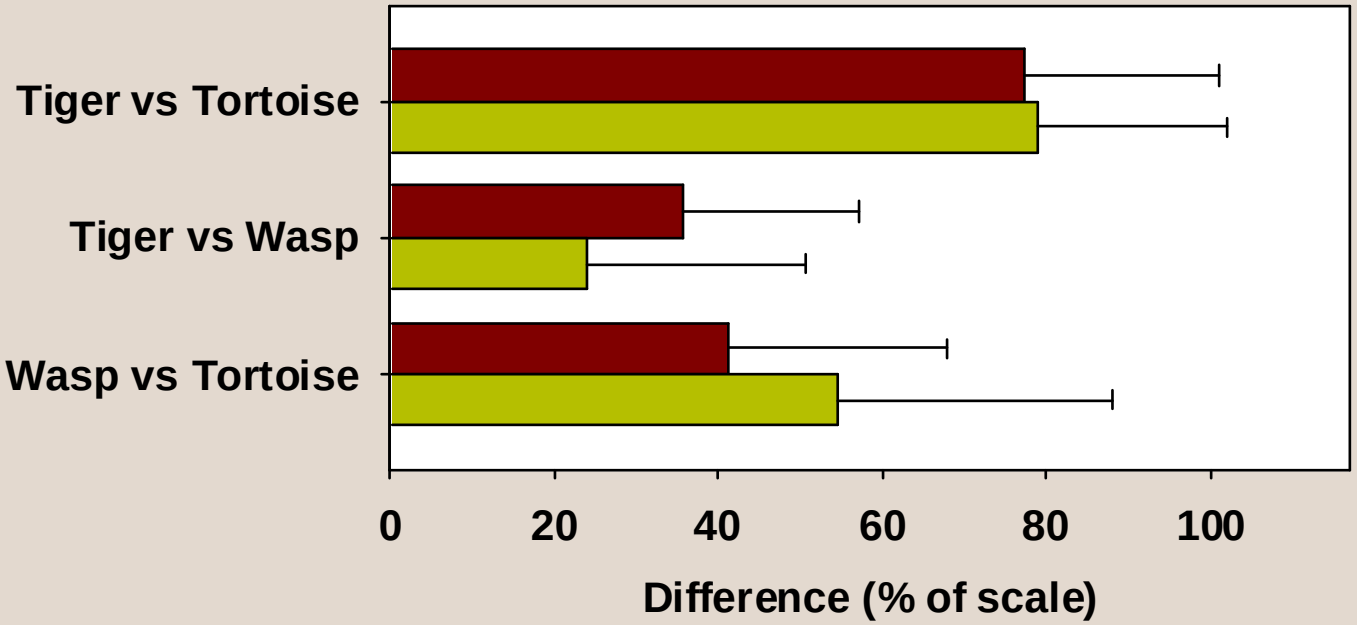
Wasp

Small – Large

Quiet – Noisy

Harmless – Dangerous

Harmless-Dangerous VAS



Use of VAS by Older Patients

- Older volunteers had no difficulty understanding the task or completing the scales
- No significant difference between scores for younger and older users
- These volunteers were healthy: Situation may be different for older patients who are ill.

Sensitivity of VAS

the rater can make as fine a discrimination [...] as he chooses (Freyd, 1924)

In principle, it would be expected that scale sensitivity would increase with the number of scale points, with the gain diminishing as the number of points increases. Thus there would in practise be a maximum useful number of subdivisions

How many intervals?

- Statistical Modelling
- Just noticeable differences
- Empirical Studies

Sensitivity of VAS

- Statistical Modelling
  - Symonds (1924) suggested that there is little to be gained by using more than seven intervals
  - Champney and Marshall (1939) suggest up to 24 points may be useful
- Just noticeable differences
  - For pain, about 25 distinct levels can be discriminated (Hardy et al., 1952)

Sensitivity of VAS

- Empirical Studies
  - VAS and 11-point NRS appear to have similar sensitivity
  - Shorter VRS less sensitive
  - Main reason for choosing between VAS and NRS should be ease of use, and interpretation of data.

See, e.g., Preston and Colman (2000); Williamson and Hoggart (2005)

Scale properties

- Interval/Ratio – Evidence
- Transformations: Log, Arcsin
- Importance for interpretation/MID/Factor Analysis

Scale properties

[VASs...] fix in a continuum in the mind of the observer. They suggest equal intervals (Kerlinger, 1986)

- Little reason to assume that verbal rating scales give equal intervals
- Difficult to find a stable verbal descriptor for the mid-point ("moderate") of the response frame.
- VAS and NRS avoid this problem
  - But that doesn't prove the intervals *are* equal

Scale properties

- Evidence for ratio properties of VAS pain ratings (Price et al., 1983; Myles et al., 1999)
  - Allows interpretation as % reduction in symptoms
- Relationship between NRS and VAS not linear (Price et a., 1994; Hartrick et a., 2003)
- Verbal rating scales may show non-linearity in response scaling (Pesudovs & Noble, 2005)

Clinically Important Differences

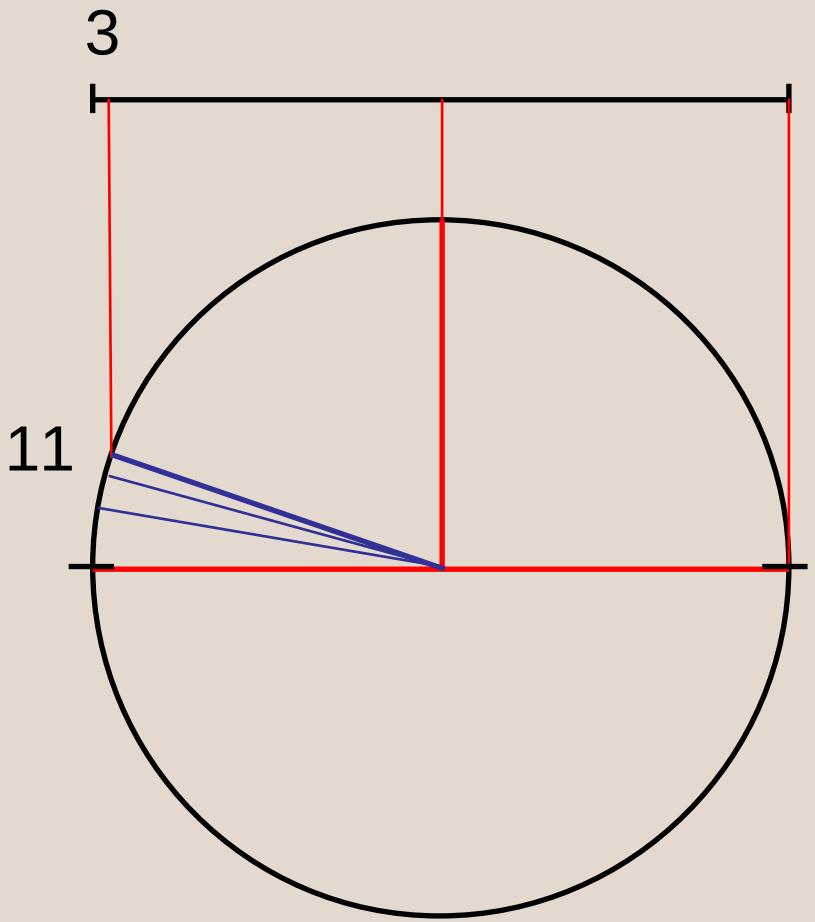
- For efficacy assessment, it is desirable to establish whether an observed change is clinically important
- The minimal clinically important difference (MCID) is the smallest change that is worthwhile
- MCID can be assessed from global ratings of change, or by direct questioning of patients (cognitive interviewing)
- MCID for VAS is approximately 13-14% for a number of indications (see e.g. Todd et al., 1986)
- Important to know if MCID varies with initial score

Transformations

- Some authors have used log transformation of VAS scores (e.g. Bond and Lader, 1974)
  - May improve normality when data are skewed due to many values near end of scale
- However
  - Log(0) is undefined, so arbitrary value must be added to scores
  - Log is asymmetric transformation applied to a symmetric scale

Arcsin Transformation

- Symmetric transformation that “stretches” both ends of the scale



Arcsin Transformation

- Symmetric transformation that “stretches” both ends of the scale
- May be useful to improve normality
- If original scale has ratio property, transformed scale will lose this

Automating VAS

- Computerised VAS eliminate need for manual scoring

  A major benefit!

- Performance tests are generally carried out on computers, VAS naturally fit into automated test battery
- As computers become more portable so do test applications

Portable assessments

- Everyday life
  - Handheld devices can be used as electronic diaries, to capture mood or symptoms at home or at work
  - Allows detailed picture of fluctuations to be built up, and relationships between different factors can be established
  - Devices can give reminders, and record entry times, thus improving and documenting compliance

Ecological Momentary Assessment

Portable assessments

- Miniature lab
  - Portable devices offer a convenient way of carrying out assessments in situations where bulky equipment is not practicable, such as hospital wards
  - Does the reduced size have an effect on the quality of the assessments?

Equivalence of data

- VAS on paper are nearly always 100mm
- On handheld (e.g. palm-sized PDA) scale must be shorter, typically 40-50 mm
- Several studies have showed equivalence of these scales to paper originals (e.g. Jamison et al., 2002)

Even smaller

- Smaller devices such as mobile phones may also be used
- Phones are familiar to users, who may already own a suitable device
- Design issues become more challenging as size decreases

Mobile Phone VAS

- We set up a VAS as a 21mm scale
- The scale was initially blank, so as not to bias the entry
- The respondent taps a left or right key, and a cursor appears on the tapped side

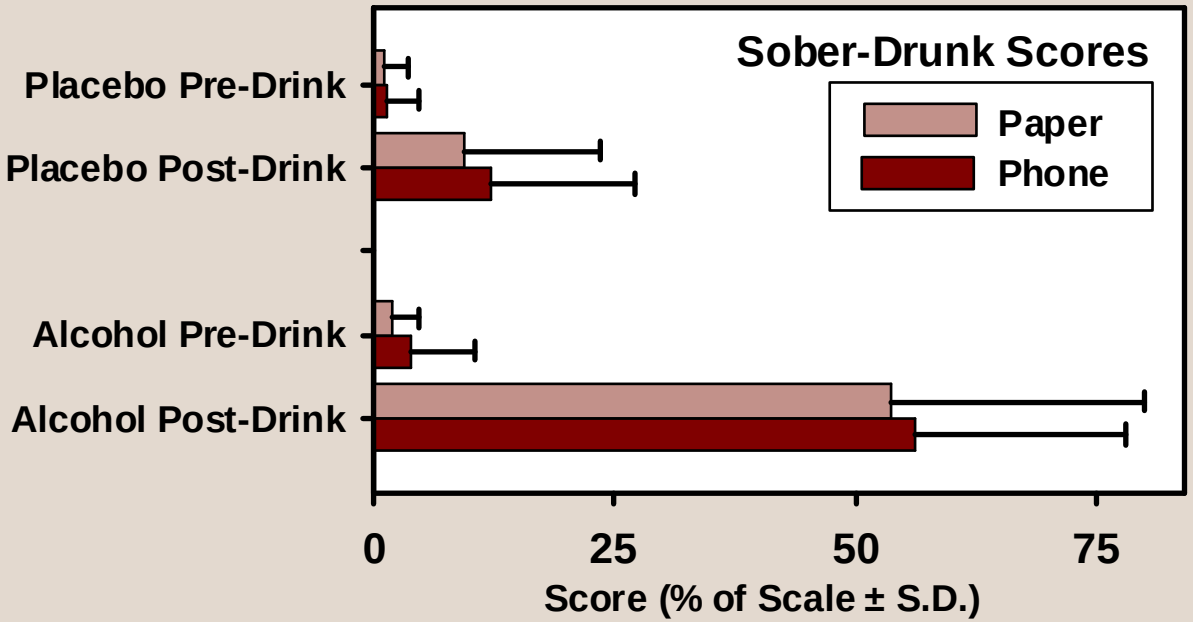
Mobile Phone VAS

- The respondent then taps the left and right keys to adjust the cursor
- The scroll up key then confirms the entry

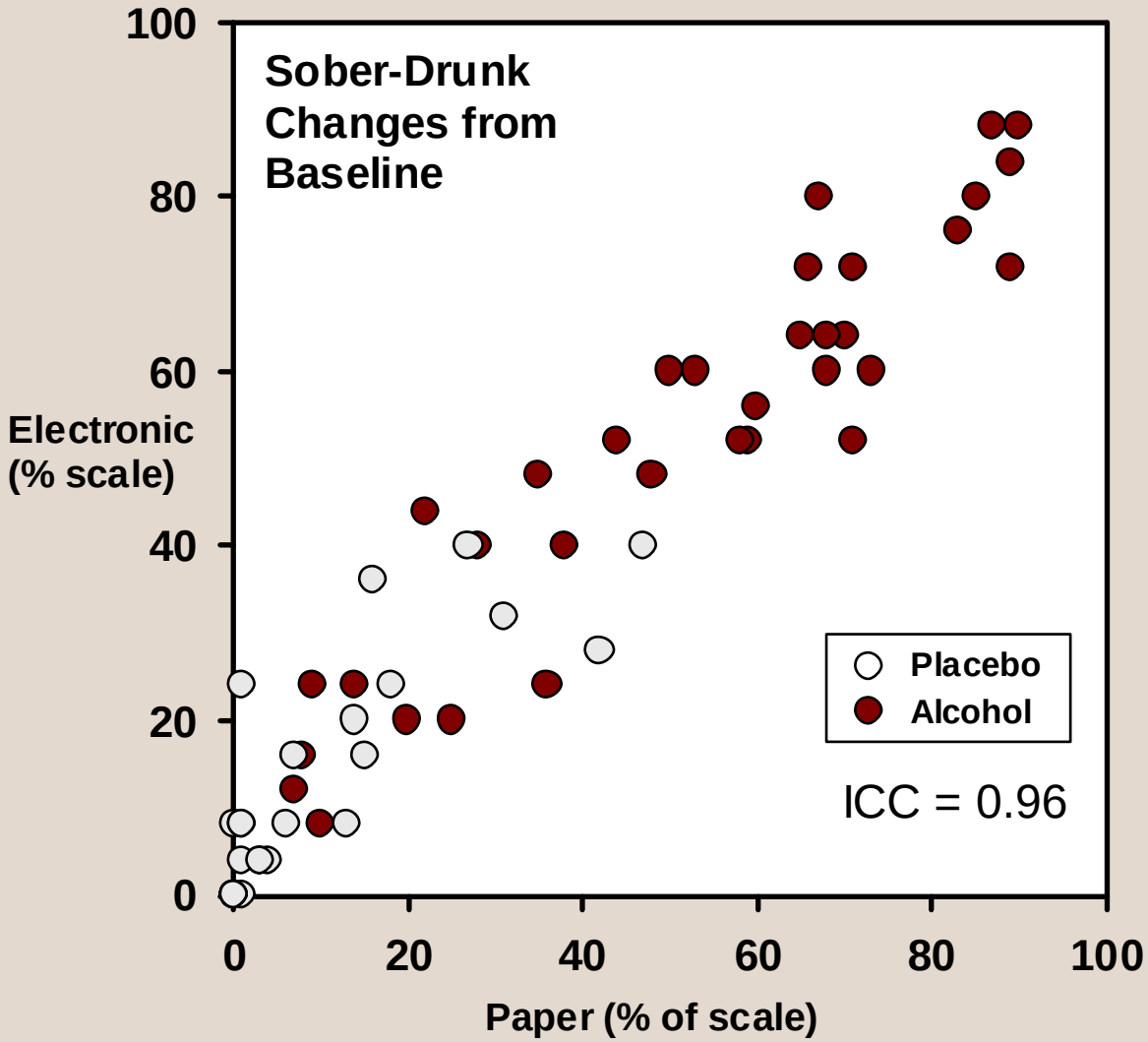
Validating the 21mm VAS

- 65 healthy volunteers (30 male) took part
- Age 19-54 years (mean 23)
- Weight 52-115 kg (mean 70).
- 34 consumed a drink containing vodka and orange juice, giving a BAC of 84 mg/100ml
- 31 took a placebo drink containing water and orange juice.
- Assessment were made between 30 and 90 minutes after the start of the drink using paper and mobile phone in randomised order

Validating the 21mm VAS



Validating the 21mm VAS



Validating the 21mm VAS

Conclusions

- The 21 mm mobile phone visual analogue scale is as sensitive as the 100 mm paper scale in detecting subjective effects of ethanol
- There is very good agreement between the two methods of assessing alcohol effects
- VAS are little affected by scale length over a wide range, supporting the use of portable implementations of these scales

Everyday Life Assessment

- Initial studies show good compliance
- Comparison of effects of ethanol in laboratory and in everyday life shows similar effects on both subjective and objective measures

Everyday Life Assessment

Examples

- Relationship between sleep and mood/performance the following day
- Following effect of treatment on a fluctuating condition, such as fibromyalgia or chronic fatigue syndrome
- Dynamics of appetite and food intake

Visual Analogue Scales

- Versatile
- Valid in a wide range of settings
- Easy to use
- Straightforward to interpret

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Contact: brian@penscreen.com
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