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Single Cases are Complex

Editorial comment on Flink et al 'Happy despite pain: A pilot study of a positive psychology intervention for patients with chronic pain'.

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In this issue of the *Journal* Ida Flink and her colleagues report a short series (n = 4) of single case experiments testing the potential impact of a positive psychology intervention for people with chronic pain on self-report measures of affect and catastrophizing. The study is notable for several reasons. First, it is among the first to apply positive psychology techniques to chronic pain. Most current psychological methods are guided by the ubiquitous cognitive-behavioural strategy that focuses on 'negative' thinking and appraisal processes that are presumed to be causally related to poor adjustment. The primary aim of CBT is thus to reducing distress and improving function. By way of contrast positive psychology aims to increase the ratio of positive to negative emotions by strengthening positive affect and well-being.

Flink et al. used a set of positive psychology exercises that have been shown to produce beneficial effects with other groups (summarised in Table 2 of their article). Second, the authors elected to use experimental single case methodology to test the intervention. The fundamental features of single case methods are many repeated observations across different conditions e.g., no-treatment and treatment, so that the participant acts as their own control. The test of the impact of the treatment is made by comparison of the measures across control and treatment conditions. Third, Flink et al. attempted a replicated case series rather than a single opportunistic case report. They provide an account of the sampling frame and selection of participants; this is not always found in reports of single case series. Fourth, they made multiple measurements at different 'levels' of data. This feature is elaborated later.

Notwithstanding these features this is a difficult dataset to interpret unambiguously. Interpretation of the graphical data displays is not easy because there is marked variability within the baseline and treatment phases and the data plots are complicated by the presentation of multiple measures within the same plot (Figures 5-7). But there is some evidence of effects, especially for participant 2, but none of the effects is marked. The merit of this article is the attempt to adapt single case methodology to a novel intervention in the study of treatment for chronic pain.

There are many advantages to adopting single case methods [2] and I and my colleagues have recently argued that at the present time further development of psychological treatments for chronic pain does not need further randomised controlled trials [9]. Experimental single case methods are an efficient way of investigating and establishing causal components of treatments. They are

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inherently tailored to the individual and can be adopted within clinical settings as part of on-going evaluation. Single case methods are not new in the psychological treatment of pain. Fordyce's seminal work on chronic pain was based on replicated single case data [7] and more recently Vlaeyen and colleagues have demonstrated the effectiveness of graded exposure for a subset of people with marked behavioural avoidance (see chapter 7 in [13]). However, as with all research methods considerably thought must be given to their implementation, analysis and interpretation.

Experimental single case methods have a long history in clinical psychology. Their development 50-60 years ago can be traced to the influence of MB Shapiro in the UK and BF Skinner's behavioural analysis in the US. The basic formal experimental designs were laid out in a seminal paper by Baer et al. in 1968[1]. The essence of all the formal designs is to arrange phases of data collection which, under appropriate conditions, enable the researcher to detect change and eliminate plausible rival hypotheses for the change. In the prototypical randomized between-subject trial observations are made pre and post-treatment and the test of effect is the difference between group means at post-treatment. This basic design allows one to exclude several rival hypotheses such as the impact of extra-treatment events (history), natural development trends (spontaneous remission) and statistical regression to the mean. In a single case design, these and other confounds are controlled for within subject.

Fink et al. used a simple two phase baseline-treatment, known as an AB design. Strictly speaking AB designs lack a key experimental manipulation i.e., reversing the treatment, but repeated measurement and *successful* replication across individuals can offset this. AB designs can include a crucial element of experimentation when the change of phase is randomly determined. In this case randomization applies to when treatment is initiated not who gets the treatment. Randomisation also offers the single case experimenter the powerful analytic tool of formal randomization tests [10].

Historically the dominant method for analysing single case data has been to inspect the data plots. Visual analysis works well when there is little variability within phases, where changes in the data associated with each phase are immediate, large and stable, and where the dependent variable is functionally determined and reliably measured. These conditions are often met in applied behavioural analysis where dependent variables are defined idiosyncratically and their functional

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relationships to treatment (usually reinforcers) are established. Flink et al's study does not meet these conditions. For example, the main measures of interest were not idiographic and the treatment had multiple components. This presents several challenges in designing single case investigations to answer question of whether positive psychology techniques can be beneficial. Flink et al's methods went some way towards dealing with these issues.

At the heart of established single case methods is a focus on a single dependent variable usually measured ideographically and a 'simple' intervention, but these methods can be added to in a systematic way to represent what Elliott has called the rich case record [4]. Figure 1 provides a schematic account of the types of data, design and analytical options for single case analysis. Figure 1 represents the levels of data, design and analysis options available.

Figure 1 about here

Standardised measures are very familiar. These are group-based (nomothetic) measures with known psychometric characteristics and normative data. By design they are not suitable for frequent repeated use and they only capture what people have in common and they may not be very sensitive to change within an individual. They are frequently used in RCTs and many other studies. The psychometric properties allow us to do two things: locate an individual and determine whether any change over time is reliable and clinically important [6]. Flink et al. included this type of measure (see Table 4 in Flink et al.) and the relevant analysis. However, pre-treatment to post-treatment changes do not allow us to conclude that treatment is responsible for the change. Repeated measurements of specified 'target' variable using single case designs can solve this issue. Flink et al. elected to use weekly assessments of affect and catastrophizing as their target for treatment but they assessed these using standardised measures. This is acceptable but alternative strategies for selecting measures that have particular salience for the individual and more frequent measurement, via daily diaries, might be preferred. The 'target' level data can be analysed by both visual [3] and statistical methods and availability of statistical models capable of handle time series data is rapidly expanding [11].

Process levels are perhaps the most difficult to conceptualize within a single case framework. Flink et al. named a number of measures as process and argued

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that changes in these measures were likely to occur if treatment was effective. This is similar to the incorporation of process measures in traditional between group studies and the measures refer to rather substantial constructs such as optimism and psychological flexibility. Within single case methodology process variables can have a rather different characterisation that is particularly useful when complex multicomponent treatments are implemented. For example, cognitive-behavioural treatments frequently incorporate behavioural experiments designed to change an essential component. So in standard CBT for depression the analysis and challenge of an identified negative though should result in a reduction in the believability of the thought, and this change should occur within session e.g. [12]. Flink et al. used a series of mini-experimental exercises e.g., silver lining, the best possible self imagery task, all which might be expected to have within session effects. Process measures in single case studies can be used to derive evidence that the components of the intervention are having their intended effect. It is possible to investigate this aspect of process using formal alternating treatment designs e.g. [8] with the appropriate statistical or visual analysis. Finally, single case methods can also include transcripts of session and the possibility of sophisticate textual analysis of specific episodes of change [5]. These task-process analyses are more common in the mental health literature but do not appear to have been applied to the problem of pain. Both process and textual analysis may be of significant benefit when investigating complex multi-component treatments like the one used by Flink et al. Investigating the effects of each component rather than bundling the components together thus mimicking the imprecision of current multicomponent trials might lead to a better treatment.

Flink et al's study is interesting because although it does not offer compelling evidence for the effectiveness of a positive psychology intervention it does illustrate the potential of thoroughly investigating the effectiveness of treatment with an established methodology. Experimental single case methods are sophisticated and complex could be used more effectively to develop and evaluate treatments. As in all scientific methods the aim of single case methods is to exclude plausible rival hypotheses that might explain the data. Careful design and replication is at their heart.

Conflict of Interest

The author declares no conflict of interest.

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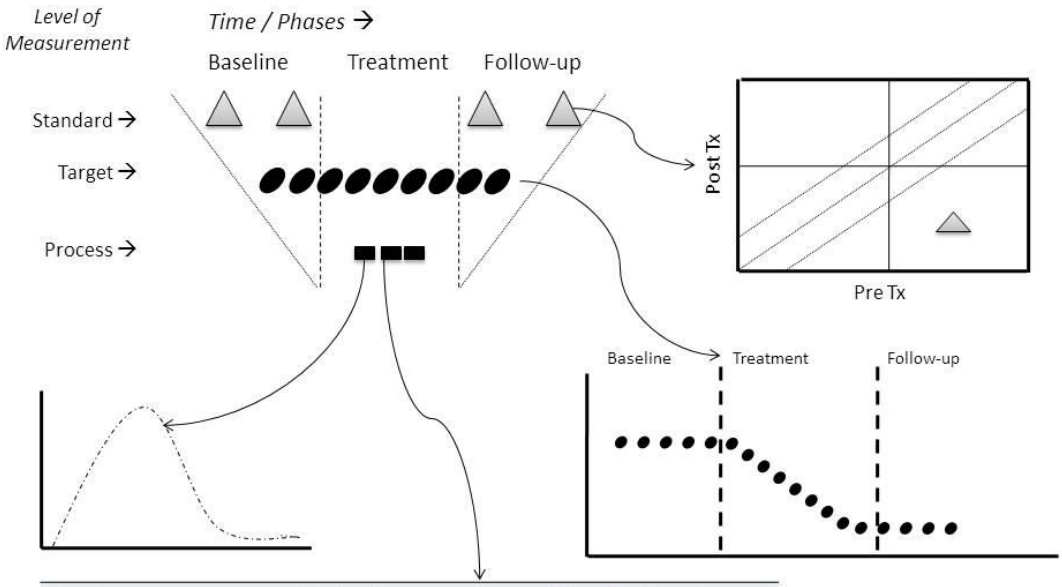

Session	Content	Extra Treatment
1 Assess	*Text*	*Text*
2 Assess	*Text*	*Text*
3 Treatment	*Text*	*Text*

Legend for Figure 1

The figure depicts a general strategy for selecting measures and determining when to take them in single case experiments. The upper left side shows a general schema in which observations may be made in time across different treatment phases. The sequence shown here is baseline – treatment – follow-up, but more elaborate designs are available. Single case methods focus on many repeated measures as indicated in the target level of measurement. Target measures are often idiographic i.e. the content and scale is unique to the individual and they capture focal problems. These data are often analysed using graphical plots as shown in the lower right of the figure. Standard measures are nomothetic measures and are often not suitable for rapidly repeated administration. They contain items that are selected for the population as a whole and they may not be sensitive to an individual's target problems. Taking standard measures prior to (at referral and pre-treatment) and after treatment (post-treatment and follow up) will be sufficient to determine reliable and clinically significant change. The upper right of the plot illustrates a tramline display and analysis that often used for these data - see reference [6]. The figure also indicates process measures which may be deployed intermittently (usually within treatment sessions) to monitor treatment sessions. These data can be analysed with a range of methods – graphical, statistical and using text analysis.

The figure is developed from Figure 12.2 in S. Morley, Single case research. In G. Parry & F. N. Watts (Eds.), Behavioural and mental health research: A handbook of skills and methods (2nd ed., pp. 277-314). Hove, England UK: Lawrence Erlbaum Associates, Inc.

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