

## TOO MANY VARIABLES, OR TOO FEW SUBJECTS?

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### 1. INTRODUCTION

I have been presented with a number of longitudinal studies in which the number of variables,  $p$ , has been quite large relative to the number of subjects (cases),  $n$ , in the study. I have been concerned that, as a result, many of the statistical tests have had little power. It has also worried me that I have not been able to find any published recommendations of how to determine an appropriate number of subjects for each treatment group. To motivate discussion, an example is given of one particular study which came to my attention.

### 2. EXAMPLE

The study was conducted by an M.Sc.(Hons) student in the Department of Human Movement Science at The University of Wollongong. His aim was to compare the effects of four treatments on acute stress. These treatments consisted of a Control, a Placebo (listening to music one lunchtime per week), Yoga, and an Exercise programme. Twelve female students under 25 years of age were allocated at random to each treatment group. Four students eventually dropped out of the Yoga group. As a result, the Yoga group had eight subjects, and the other three groups had twelve subjects each.

To create stress, students were required to follow a light around a rotor, and they were scored according to the length of time that they kept a pointer in contact with the light. This was done ten times during a testing session. Observations were taken on a number of variables at one testing session early in the exercise programme, and then at a second session at the end of the programme. The variables which were thought to measure stress were recorded at the beginning, middle and end of the testing session on each of these occasions. This may be represented schematically by the diagram in Table 1.

In all, 97 readings were taken on different variables. Many of these were in the nature of repeated measurements, but there were 18 or 19 separate variables whose values were recorded. They are set out in Table 2, together with the number of measurements made on each one.

Many of the analyses requested were repeated-measures ANOVAs in