A longitudinal study of behaviour-disordered adolescents and the effects on them of a wilderness-enhanced program

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Chapter 7

The Formation of Data Sets

The first part of this chapter examines levels of attrition and the subsequent establishment of two data sets identified as the longitudinal sample and the cross-sectional sample. The longitudinal sample comprises all subjects who were present and completed questionnaires at four data collection stages across the complete duration of the study. The cross-sectional sample varies in number from time to time, as attrition and absenteeism affect numbers, but it represents the total number of subjects, including the longitudinal sample, available at each data collection stage (time).

The second part of the chapter discusses the statistical treatment of the data. This includes the reasons why a MANOVA was used as well as an ANOVA. This is followed by three chapters focussing on analyses of the data.

7.1 Panel Loss Due to Absenteeism and Attrition

There were three groups of subjects in this study:

- **WEP**: The treatment group that had undergone a wilderness-enhanced program (WEP).
- **CON**: The control group (CON) of behaviourally-disordered students who received no special help outside their school.
- **REF**: The reference group (REF) of normal-stream students, who displayed no noticeable behaviour problems.

The treatment group (WEP) data were compared to their own T1 commencement scores in order to measure change during the program. In addition, the WEP group data were compared to a control group (CON) in order to further examine the nature of program impact. The reference group (REF) was used as a normative comparison group, to permit normal attitude and behaviour change with maturation to be used as a guide in ascertaining statistical and clinical changes in the WEP and CON groups to be assessed.
The numbers of subjects (all male) can be seen more clearly in Table 7.1 below.

<table>
<thead>
<tr>
<th></th>
<th>Time 1 (Pre-treatment)</th>
<th>Time 2 (6 wks later)</th>
<th>Time 3 (6 mths later)</th>
<th>Time 4 (6 mths later)</th>
<th>Time 5* (9 mths later)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEP</td>
<td>73</td>
<td>49</td>
<td>49</td>
<td>41</td>
<td>34</td>
</tr>
<tr>
<td>CON</td>
<td>52</td>
<td>47</td>
<td>47</td>
<td>47</td>
<td>37</td>
</tr>
<tr>
<td>REF</td>
<td>65</td>
<td>0</td>
<td>59</td>
<td>57</td>
<td>43</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>190</strong></td>
<td><strong>96</strong></td>
<td><strong>155</strong></td>
<td><strong>145</strong></td>
<td><strong>113</strong></td>
</tr>
</tbody>
</table>

*Total duration of data collection was 24 months.

All longitudinal studies experience subject loss due to attrition and absenteeism (Hansen et al, 1985, Wragg, 1992) and this study, spread over a two year data collection period for each cohort, was no exception. The study, with a total number of students N=190, was made up from two separate cohorts of subjects from 1994 and 1995, each followed for a two year period.

It became an increasingly difficult task to keep track of the treatment group subjects. Due to the nature of the group, they tended to drop out of school, change their residential address frequently, often with no forwarding address or contact number, and have no steady job or place of learning. Whereas only two of the control group and eleven of the reference group moved out of the area, making data collection extremely difficult, thirty-one of the treatment group were lost due to moves making them untraceable or reaching them impractical. The study was restricted by a lack of funds: there simply were not the resources available to be able to spend large amounts of time tracking down hard-to-find subjects or travelling long distances to them to administer the questionnaire. One subject moved to Cyprus, others to New Zealand, Coffs Harbour, Dubbo, Coonabarabran and Muswellbrook. Others simply lived too far away to enable data to be collected once they had left school: Eden, Ulladulla, Queanbeyan, Vincentia and Crookwell. An attempt was made to collect data by posting a
questionnaire and stamp-addressed return envelope to these subjects but the return rate on these was only about five per cent.

Due to absenteeism, student transfers, or dropouts and family restructuring following separation and remarriage, subjects were lost from the study. In addition, reference subjects were lost at each of the data collection stages due to absence on the day the school was visited with the questionnaires. This was especially so at one of the rural high schools. An effort was made to chase absent subjects up soon afterwards, and some responses were completed. Generally speaking, missing subjects due to absenteeism was not a great problem with the reference and control groups. Less than five per cent of available subjects' data were not collected in the control and reference groups. A few other subjects in these groups were lost due to incomplete or invalid questionnaire responses.

However, 20% of one of the rural high schools' cohort withdrew after the first data collection. The cause of this attrition was the requirement placed on the study by the New South Wales Department of School Education requiring consent from the parents or guardians of the subjects to be obtained. This 20% failed to return a permission note and so had to be dropped from the study. With the other reference groups, permission notes were sent home first. With the control and treatment groups, the same procedure was adopted, but home visits followed to collect the permission notes if they had failed to return. Attrition during the remaining collection points was subsequently reduced within the control and reference groups, as they generally remained at school and, therefore, within easy reach.

The combination of attrition and absenteeism meant that results to be reported are based on a reduced sample at each of the follow-up stages. At the cross-sectional level, results are reported generally on 74% of the original sample, which represents a fairly substantial percentage of the original population when the duration of the study is taken into account. The sample used for the longitudinal analysis (N=97) represents just over half of the original group (50.6%) and thus attrition over the three years averages approximately 16% per annum. Table 7.2 presents a comparison of panel loss due to attrition and absenteeism for all groups.
Table 7.2: Percentage of Subjects Retained from Original Sample after Losses from Attrition and Absenteeism

<table>
<thead>
<tr>
<th>Trial (Data Collection Point)</th>
<th>Complete Sample (N=190)</th>
<th>Treatment Group (N=73)</th>
<th>Control Group (N=52)</th>
<th>Reference Group (N=65)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Time 2</td>
<td>**</td>
<td>69%</td>
<td>90%</td>
<td>*</td>
</tr>
<tr>
<td>Time 3</td>
<td>81%</td>
<td>69%</td>
<td>90%</td>
<td>91%</td>
</tr>
<tr>
<td>Time 4</td>
<td>74%</td>
<td>55%</td>
<td>90%</td>
<td>88%</td>
</tr>
<tr>
<td>Time 5</td>
<td>61%</td>
<td>47%</td>
<td>71%</td>
<td>65%</td>
</tr>
<tr>
<td>Longitudinal Subset (Time 1 to Time 5)</td>
<td>51%</td>
<td>31%</td>
<td>61%</td>
<td>65%</td>
</tr>
</tbody>
</table>

* Data missing at Time 2 for Reference Group
** Due to no data at Time 2 for Reference Group, overall percentage could not be calculated.

Attrition figures are not often reported, but when they are figures of between five and fifteen per cent per annum are mentioned for studies completed during a two to three year period. Rates have been as high as 35% per annum in some studies (Hansen et al, 1985, Flay et al, 1985). Josephson and Rosen (1978) comment that where studies have been required to preserve anonymity, to match by self-created code numbers and to rely on self-administered questionnaires, relatively high attrition has occurred.

Because the longitudinal sample was reduced in size, the results of both the longitudinal and cross-sectional samples was reported in order to compare the nature of responses across both samples. If it was found that the results from the larger cross-sectional sample corroborated the findings obtained after analysis of the longitudinal subset, then greater confidence can be placed in the findings and their application to a wider population. Although the cross-sectional sample did change at each of the
data collection times, it is worth noting that 97 students (representing 51% of the original sample) had data available for four out of the five data collection stages and therefore, when results were reported for the cross-sectional group, half of that group was consistently present for almost all the data collection stages. (The missing data was largely accounted for by the reference group having no trial 2 data. It was not expected that change would occur in the initial six-week period between T1 and T2 as this group was not undergoing any special treatment or program.)

7.2 Initial Considerations Regarding Data Analysis Procedures

The analysis of data collected across five school grades (Years 6, 7, 8, 9 and 10) should reflect the changing nature of behaviour over time. For example, the vast majority of children and young adolescents are infrequent users of most drugs and seldom participate in sexual intercourse, whereas by Year 10 many adolescents are experimenting with both these behaviours. The reference group of normal stream adolescents should reflect these changing behaviours over time.

In initial analyses of the variables the distributions were found to approximate bell-shaped curves, with acceptable homogeneity of variance, and therefore the decision was made to analyse the data using parametric techniques.

The method of analysing the data first chosen for this study was a repeated measures mixed model design. It was analysed using a multivariate approach. This consisted of within-subject observations across treatment conditions and the individual treatment measures were viewed as separate, correlated dependent variables. In this type of analysis, each level of the repeated factor is treated as a separate variable (Olsen, 1976). This multivariate analysis of variance (ANOVA) has an advantage over the univariate test in that it requires no assumption of sphericity. Some statisticians recommend that the multivariate ANOVA be used frequently, if not routinely, with repeated measures designs (Davidson, 1972). It was selected for the longitudinal data set because the n size was reduced. This analysis was carried out using the SPSS-X MANOVA program. In all subsequent discussion, each of these
analyses will be referred to as a multiple analysis of variance (MANOVA), even though, technically speaking, it is really a repeated measures mixed model ANOVA.

The MANOVA was used to ascertain significant changes between the three groups over time. MANOVAS were run on all the variables contained in the study. The MANOVA was run on four testing times, namely T1, T3, T4 and T5. T1 was the initial (pre-test) time. There was no T2 data (6 weeks after T1 and straight after the treatment group's wilderness experience) included in this procedure as none was collected at this time from the reference group. (When it was necessary to examine the change between T1 and T2, an ANOVA was used.) T3 was six months after T1, and T4 was six months after that. T5 was then nine months later. Therefore the MANOVA was looking for significant differences over a two-year period. Comparisons were made over time and also between the groups. The MANOVA was used to control for Type I and Type II error rates that escalate exponentially as the number of dependent variables increases (Haase and Ellis, 1987).

Only about one quarter of the variables showed interactions between the groups using the MANOVA. This was, to some extent, expected due to the smaller sample size, although the sample size was still above the acceptable lower limits for this type of analysis. This, in turn, was due to the high attrition rates of the treatment subjects and the difficulty in keeping track of them regularly to obtain complete data sets over four testing times. The results did show that there were significant differences between the groups on most of the variables.

The number of subjects available for the MANOVA procedure was slightly more than half the total subject population (N=97). This then varied a little, depending on the variable being analysed, as some subjects had missing data for a particular variable. The Hotelling's trace was reported along with significance of F values (tests of significance using UNIQUE sums of squares) for the interaction of group by trial and effects of trial; significance of F values were also reported for between-subject effects.
A second procedure was then used to analyse the data, using the cross-sectional data set. A one-way analysis of variance (ANOVA) was used to try and detect differences between the groups at each of the different time periods. Because the ANOVA was able to use larger sample sizes (total N=190) it improved the power of the analysis, although it also increased the probability of Type I and Type II errors occurring. The numbers of subjects available for the ANOVA procedure varied over the five data collection points, with a decrease towards the end of the study. The minor variations can be accounted for by some subjects having missing data for a particular variable.

Analysis of variance (ANOVA) from the SPSS-X package was used in order to examine the effect of intervention across all the times for all of the thirty-one variables considered in the study. A ONEWAY command was used to produce a one-way analysis of variance for an interval-level response variable by one explanatory factor (time). ONEWAY produced a standard analysis of variance table for each dependent variable. The RANGES subcommand was used to specify the Scheffé test for significance (alpha level 0.02), which was appropriate for multiple comparisons between means.

T-tests were also employed to ascertain significant differences in the treatment group between T1 and T2 and between T1 and T5. The results of these tests are included in the results chapters where appropriate, that is, where they add to the information already gathered from the other procedures.

Because the study involved so many variables, the problem of Type I and Type II errors occurring had to be considered. The procedures undertaken to guard against this included the use of a repeated measures mixed model analysis which reduced the likelihood of error. It was also decided to decrease the alpha level of significance from 0.05 to 0.02.

The results of the analysis of each subscale, representing the variables included in the study, are presented in the following chapters in the order following Jesser and Jesser’s Problem Behaviour Proneness model. Chapter 8 deals with the personality system, Chapter 9 with the perceived social environment system and Chapter 10 with the behaviour system.