ANOVA – Model Answers

a) 2x2 mixed ANOVA on Positive Affect (PA) between the Control and Intervention group, before (Time 1) and after (Time 2) study manipulation.

A 2x2 mixed model Analysis of Variance (ANOVA) was conducted in order to examine the levels of Positive Affect (PA) reported by patients in the two research groups (Intervention and Control) before (time 1) and after (time 2) receiving their diagnosis. None of the assumptions of the data were violated. The analysis revealed a significant main effect of the within-subjects variable of time F (1, 340) = 30.23; $P < 0.001$, partial $\eta^2 = 0.08$, with significantly lower levels of positive affect reported at time 2 (M=23.39, SD=7.89) compared to time 1 (M=25.52, SD=8.53). There was no significant main effect of the between-subjects factor of group F (1, 340) = 1.12; $p = 0.29$, partial $\eta^2 = 0.003$, suggesting that positive affect did not differ overall between those in the control group and those receiving the intervention. However, there was a significant interaction between group and time F (1, 340) = 9.60; $p < 0.01$, partial $\eta^2 = 0.03$. The interaction revealed that the PA scores were significantly lower at time 2 compared to time 1, but only for those in the control group and not for those in the intervention group. This finding would suggest that the intervention has been successful at reducing the likelihood of patients feeling less positive following their diagnosis.

b) 2x3 mixed ANOVA on distress scores between the Control and Intervention group, across three time-points (Planned/Post-hoc comparisons)

A 2x3 mixed model Analysis of Variance (ANOVA) was conducted in order to examine the levels of distress experienced by patients in two different research groups (Intervention and Control) at three separate time-points (Time 1: Referral, Time 2: Waiting, Time 3: After Diagnosis). Mauchly's test of sphericity indicated that the assumption of sphericity had been violated ($X^2(2) = 30.93$, $p < 0.001$). Therefore, estimates from Greenhouse-Geisser values are reported for the within-subjects variable of time. None of the other assumptions of the data were violated. The analysis revealed no significant main effect of group F (1, 268) = 0.003; $p = 0.96$, partial $\eta^2 = 0.000$, indicating no difference in overall distress between those in the control group and those who received the intervention. There was also no significant interaction between time and group F (1.803, 483.150) = 0.06; $p = 0.93$, partial $\eta^2 = 0.000$, meaning there was no significant difference in levels of distress reported between the control and intervention group at any time point. However, there was a significant main effect of time F (1.803, 483.150) = 6.527; $p < 0.01$, partial $\eta^2 = 0.02$. Given that the main effect of time was significant, a series of post-hoc pairwise comparisons were conducted to further explore this significance, due to the factor of time containing three levels. Employing the Bonferroni post-hoc test revealed that for both of the groups, levels of distress were significantly higher during referral (Time 1) than during waiting (Time 2) ($p = .02$), and higher during referral (Time 1) than after their diagnosis (Time 3) ($p = .0007$). There was no significant difference between levels of distress whilst waiting for a diagnosis (Time 2) and after receiving the diagnosis (Time 3) ($p = .68$). These findings suggest that regardless of whether patients receive an intervention or not, their distress levels appear to decrease significantly as time proceeds. Therefore, there research should focus on attempting to

uncover whether there are any other factors that may be influencing patients' levels of distress over time other than the current intervention.

c) 2x3 mixed ANOVA on the interaction between Group (Control vs. Intervention) and Time-point (1, 2, 3).

A 2x3 mixed model Analysis of Variance (ANOVA) was conducted in order to examine the levels of distress experienced by patients in two different research groups (Intervention and Control) at three separate time-points (Time 1: Referral, Time 2: Waiting, Time 3: After Diagnosis). None of the assumptions of the data were violated. There was no significant main effect of the between-subjects factor of group F (1, 268) = 1.245; p = 0.27, partial η^2 = 0.005, indicating no difference in overall distress between those in the control group and those who received the intervention. There was a significant main effect of the within-subjects factor of time F (2,536) = 5.096; $p < 0.01$, partial η^2 = 0.02. However, there was also a significant interaction between group and time F (2, 536) = 4.778; $p < 0.01$, partial η^2 = 0.02. Post-hoc analyses using the split file method on pairwise comparisons using Bonferonni corrections revealed that for the Intervention group, levels of distress significantly decreased from time 1 to time 2 (p = 0.02). However, there was no significant difference in distress levels between time 1 and time 3 (p = 0.08), or between time 2 and time 3 (p = 1.00). On the hand for the Control group, distress levels did not significantly differ between time 1 and time 2 (p = 0.61), or between time 1 and time 3 (p = 0.12). However, distress levels significantly decreased from time 2 to time 3 (p = 0.003). These findings suggest that the intervention clearly had a significant impact on reducing distress levels whilst patients were waiting for their diagnosis. This could not be said for those in the control group as their distress levels were not reduced whilst they were waiting. However, it seems that once patients in the control group received their diagnosis, their distress levels also significantly decreased to a level similar to those in the intervention group.

*Note in the output for this data there is a series of t-tests for each of the groups and a split file ANOVA to further examine the interaction. The purpose of this is to show how conducting multiple t-tests capitalises on chance – the difference between the three time-points for each of the two groups is not always significant when Bonferonni corrections are applied in pairwise ANOVA pot-hoc comparisons.