

## LI Analysis Training Series

### Repeated Measures Analysis

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**Purpose:** Repeated measures analyses are used when several measures of the same variable (e.g. an outcome) are taken across different levels of a factor—(e.g. time). For our purposes, repeated measures are used to assess dependent measure changes from baseline across multiple follow-up waves, controlling for various (dichotomous or continuous) respondent characteristics.

**Background:** One of the main advantages to repeated measures study design is that subjects act as their own controls, thereby reducing variability (in individual characteristics) and resulting in more powerful results. The disadvantages of a repeated measures study design are related to performing the same measures on the same subject; subjects may recall and repeat prior responses, or they may become bored and give careless responses. Increasing the distance between measures reduces these disadvantages. Repeated measures analysis allows for more than 2 levels of the within-subjects factor (e.g. 3 or more time periods). For each level of this factor, difference scores (a.k.a. contrasts) are calculated, then these differences are pooled across the factor levels to test for a significant overall effect.

**Data Requirements:** Repeated measures analyses require continuous or dichotomous dependent variables. If covariates are used, they may be continuous or dichotomous. Factors (between-subject groups (such as gender or treatment) and within-subject factors (such as observation wave)) need to be categorical and can be numeric or string variables (for SPSS versions prior to 16 this was restricted to a maximum of 8 characters). Covariates by definition should be related to the dependent variable. Data assumptions for any analysis of variance apply, including correct model specification, an additive model, and normally distributed, independent error effects. Data assumptions specific to repeated measures (with more than 2 levels of the within-subjects factor) include equal variances and equal covariances between the repeated measures variables—known as sphericity. In our typical analysis, sphericity is confirmed when the variances of the DV differences between observation waves are equal. If the sphericity assumption is violated (i.e. Mauchly's test is significant ( $\leq .05$ )), then the basic premise of repeated measures

(pooling contrast results) may be inappropriate, resulting in overly high F values. However, the Huynh-Feldt test corrects for the violation of sphericity by adjusting the degrees of freedom in calculating the F statistic. It is acceptable to use this test at any time, since it is identical to the original results when sphericity is maintained, and corrects if the F value when sphericity is violated. The Huynh-Feldt test is a standard part of the SPSS output for repeated measures analysis.

Repeated Measures analysis assumes at least 2 levels of the within-subjects factor (i.e. time) and requires that all records have values for included variables at each level (i.e. time period.) Repeated measures analysis requires a ‘horizontal data’ file—with one record per case and one variable per measurement. For intake, 3, 6, 9, and 12 month follow-up, a simple database needed for the two examples in this document, would include the following variables:

### Variable Labels

Variable	Position	Label
xsite	1	Site ID
xpid	2	Participant ID
xobsdt	3	A1c. Today's Date (MM/DD/YYYY) - Intake
cond	4	Condition (3 groups)
s2c1_0	6	P90: Days of Marijuana Use – Intake
s2c1_3	7	P90: Days of Marijuana Use – 3 Months
s2c1_6	8	P90: Days of Marijuana Use – 6 Months
s2c1_9	9	P90: Days of Marijuana Use – 9 Months
s2c1_12	10	P90: Days of Marijuana Use – 12 Months
spsm_0	11	Substance problem scale, past month – Intake
spsm_3	12	Substance Problem scale, past month – 3 Months
spsm_6	13	Substance Problem scale, past month – 6 Months
spsm_9	14	Substance Problem scale, past month – 9 Months
spsm_12	15	Substance Problem scale, past month – 12 Months
spsy2	16	median split on past year SPS

Variables in the working file

**Procedure:** Note: GLM Repeated Measures is available only if you have installed the SPSS Advanced Models (also briefly known as PASW Advanced Statistics) option. There are multiple options and choices available for GLM repeated measures. This paper will present those most commonly selected in analyzing the Global Appraisal of Individual Need (GAIN) outcome data across intake and follow-up waves.

**Example 1:** The first simple example looks at marijuana use over time controlling for marijuana use at intake. The syntax for this analysis follows.

```
GLM
  s2c1_3 s2c1_6 s2c1_9 s2c1_12
  WITH s2c1_0
  /WSFACTOR = time4 4 Polynomial
```

```

/MEASURE = mrjuse
/METHOD = SSTYPE(3)
/PRINT = DESCRIPTIVE ETASQ OPOWER PARAMETER HOMOGENEITY
/CRITERIA = ALPHA(.05)
/WSDESIGN = time4
/DESIGN = s2c1_0.

```

S2c1 is the variable for days of marijuana use; the suffix indicates the follow-up wave, with a zero suffix indicating baseline (intake) data. The 'WITH' keyword indicates a covariate. The '/WSFACTOR=' line names the within subjects factor (time), indicates the number of levels it has (in this example, it is 4, but it is always equal to the number of times the dependent variable was measured) and specifies the type of contrast to be used. The polynomial contrast is the default option and provides linear effects followed by quadratic effects and so on. If the analysis contains equivalently sized cells, polynomial contrasts are mutually independent. Contrast levels are equally spaced by default, but unequal spacing can be specified. Other possible contrasts types include: deviation (from the grand mean), Helmert (compares each level to subsequent levels), difference (or reverse-Helmert; compares to prior levels), simple (compares to the last level), repeated (compares to adjacent levels), and special (user-defined contrasts). The '/MEASURE=' line names the dependent variable. It is useful when there are multiple variables representing the dependent variable across levels of the within subject factor (in this example—marijuana use (S2c1) across 4 levels of time). The '/METHOD' command identifies the Sum of Squares method to be used. The default method is Type III sum of squares (SSTYPE(3)) that controls for the effects that do not contain the effect being examined and are orthogonal to any higher order effects that contain the effect being examined. SSTYPE(3) is often used when cell frequencies are not balanced but are also not missing. If there are missing cells, consider using SSTYPE(4) instead. Output for this example is presented in the next section following the description of the second example.

**Example 2:** This example compares 3 to 12 month marijuana use and past month Substance Problem Scale (SPS) and includes a nested value and an interaction term. The values on marijuana use and past month SPS at intake are used as covariates, 'cond' is the treatment condition and spsy2 is a dichotomized (median split) past year Substance Problems Scale. For this analysis, condition is nested within site (/DESIGN) since each site got the same three treatment conditions.

```

GLM
  s2c1_3 s2c1_6 s2c1_9 s2c1_12 spsm_3 spsm_6 spsm_9 spsm_12
  BY xsite cond spsy2
  WITH s2c1_0 spsm_0
  /WSFACTOR = time4 4 Polynomial
  /MEASURE = mrjuse problems
  /METHOD = SSTYPE(3)
  /PRINT = DESCRIPTIVE ETASQ OPOWER PARAMETER HOMOGENEITY
  /CRITERIA = ALPHA(.05)
  /WSDESIGN = time4
  /DESIGN = s2c1_0 spsm_0 xsite spsy2 cond(xsite) spsy2*cond(xsite).

```

The differences in this example are that the 'BY' keyword is used to indicate a between subjects factor (in this case site and condition) is included. The /MEASURE subcommand now includes 'mrjuse' to name the S2c1 series of dependent variables across time, as well as the 'problems' to name the SPSM series across time. Also included in the /DESIGN subcommand are the main effects for intake levels of marijuana use (S2c1), past month substance problems (spsm), site (xsite) and past year substance problems dichotomized at the median (spsy2), the nested condition within site mentioned above (cond(xsite)) and an interaction between past year substance problem level and the condition within site term (spsy2\*cond(xsite)).

### **Output:**

#### **Example 1: Marijuana use over time Within-Subjects Factors**

Measure: mrjuse

time4	Dependent Variable
1	s2c_3
2	s2c1_6
3	s2c1_9
4	s2c1_12

Names the variables that represent each level of the within subjects factor.

#### **Descriptive Statistics**

	Mean	Std. Deviation	N
s2c1_3 P90: Days of Marijuana Use - 3 months	22.3895	26.38668	534
s2c1_6 P90: Days of Marijuana Use - 6 months	21.5225	26.87687	534
s2c1_9 P90: Days of Marijuana Use - 9 months	21.4532	27.51293	534
s2c1_12 P90: Days of Marijuana Use - 12 months	21.7978	27.79792	534

Basic information about each level of the within subjects factor. You may want to use this information for graphing across time.

This table lists various ways to examine the within subjects test and the interaction between the covariate and time-each with its own assumptions. In this example, the interaction with the covariate is significant.

### Multivariate Tests(c)

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time4	Pillai's Trace	.014	2.500(b)	3.000	530.000	.059	.014	7.500	.619
	Wilks' Lambda	.986	2.500(b)	3.000	530.000	.059	.014	7.500	.619
	Hotelling's Trace	.014	2.500(b)	3.000	530.000	.059	.014	7.500	.619
	Roy's Largest Root	.014	2.500(b)	3.000	530.000	.059	.014	7.500	.619
	Trace	.014	2.500(b)	3.000	530.000	.059	.014	7.500	.619
time4 * s2c1_0	Pillai's Trace	.028	5.113(b)	3.000	530.000	.002	.028	15.339	.921
	Wilks' Lambda	.972	5.113(b)	3.000	530.000	.002	.028	15.339	.921
	Hotelling's Trace	.029	5.113(b)	3.000	530.000	.002	.028	15.339	.921
	Roy's Largest Root	.029	5.113(b)	3.000	530.000	.002	.028	15.339	.921
	Trace	.029	5.113(b)	3.000	530.000	.002	.028	15.339	.921

a Computed using alpha = .05

b Exact statistic

c Design: Intercept+s2c1\_0

Within Subjects Design: time4

This is a test of sphericity for within-subjects DV's. The preference for Mauchly's Test is that the result is NOT significant. If it is, use one of the adjustments to the Within-Subjects Effects below (Greenhouse-Geisser, Huynh-Feldt, or Lower-bound).

### Mauchly's Test of Sphericity(b)

Measure: mrjuse

Within Subjects

Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon(a)		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
time4	.827	100.649	5	.000	.885	.891	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b Design: Intercept+s2c1\_0

Within Subjects Design: time4

Since sphericity is not assumed (i.e., Mauchly's Test is significant), use the Huynh-Feldt, adjustment row (highlighted) to determine effects. In this example, both time and the interaction between time and marijuana use at intake are significant.

### Tests of Within-Subjects Effects

Measure: mrjuse

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time4	Sphericity Assumed	3949.514	3	1316.505	3.487	.015	.007	10.461	.781
	Greenhouse-Geisser	3949.514	2.655	1487.756	3.487	.019	.007	9.257	.742
	Huynh-Feldt	3949.514	2.674	1476.871	3.487	.019	.007	9.325	.744
	Lower-bound	3949.514	1.000	3949.514	3.487	.062	.007	3.487	.462
time4 * s2c1_0	Sphericity Assumed	8056.595	3	2685.532	7.113	.000	.013	21.339	.982
	Greenhouse-Geisser	8056.595	2.655	3034.867	7.113	.000	.013	18.883	.971
	Huynh-Feldt	8056.595	2.674	3012.663	7.113	.000	.013	19.022	.972
	Lower-bound	8056.595	1.000	8056.595	7.113	.008	.013	7.113	.759
Error(time4)	Sphericity Assumed	602578.897	1596	377.556					
	Greenhouse-Geisser	602578.897	1412.289	426.668					
	Huynh-Feldt	602578.897	1422.698	423.547					
	Lower-bound	602578.897	532.000	1132.667					

a. Computed using alpha = .05

The test of within-subjects contrasts identifies the shape of the distribution of the DV over levels of the within-subjects factor (i.e., time). In this example, only the linear contrast effect is significant.

### Tests of Within-Subjects Contrasts

Measure: mrjuse

Source	time4	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time4	Linear	3338.906	1	3338.906	6.032	.014	.011	6.032	.689
	Quadratic	121.038	1	121.038	.374	.541	.001	.374	.094
	Cubic	489.570	1	489.570	1.916	.167	.004	1.916	.282
time4 * s2c1_0	Linear	6694.366	1	6694.366	12.095	.001	.022	12.095	.935
	Quadratic	644.032	1	644.032	1.990	.159	.004	1.990	.291
	Cubic	718.197	1	718.197	2.811	.094	.005	2.811	.387
Error(time4)	Linear	294460.139	532	553.497					
	Quadratic	172192.740	532	323.671					
	Cubic	135926.018	532	255.500					

a. Computed using alpha = .05

The Tests of Between-Subjects Effects in a repeated measures analysis of variance are interpreted the same way as in a standard ANOVA. In this example, *as the days of marijuana use at intake changes, so does the relationship between time and the DV.*

### Tests of Between-Subjects Effects

Measure: mrjuse

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Intercept	133350.424	1	133350.424	84.027	.000	.136	84.027	1.000
s2c1_0	116527.889	1	116527.889	73.426	.000	.121	73.426	1.000
Error	844285.318	532	1587.002					

a. Computed using alpha = .05

The partial eta squared in the parameter estimates table can be used to determine which levels of which factors are contributing the most to the model. Days of use at intake is a better predictor of 3 month use than use at later follow-ups. However, since this use of partial eta-squares is often removed from submitted manuscripts, we recommend only using it for simple effects contrasts.

### Parameter Estimates

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared	Noncent. Parameter	Observed Power(a)
						Lower Bound	Upper Bound			
s2c1_3 P90: Days of Marijuana Use - 3 months	Intercept	9.893	1.686	5.868	.000	6.581	13.204	.061	5.868	1.000
	s2c1_0	.353	.037	9.513	.000	.280	.426	.145	9.513	1.000
s2c1_6 P90: Days of Marijuana Use - 6 months	Intercept	11.070	1.764	6.275	.000	7.604	14.536	.069	6.275	1.000
	s2c1_0	.296	.039	7.603	.000	.219	.372	.098	7.603	1.000
s2c1_9 P90: Days of Marijuana Use - 9 months	Intercept	14.904	1.866	7.986	.000	11.238	18.570	.107	7.986	1.000
	s2c1_0	.185	.041	4.503	.000	.104	.266	.037	4.503	.994
s2c1_12 P90: Days of Marijuana Use - 12 months	Intercept	14.562	1.879	7.752	.000	10.872	18.253	.101	7.752	1.000
	s2c1_0	.205	.041	4.943	.000	.123	.286	.044	4.943	.999

a. Computed using alpha = .05

## Example 2: Marijuana use and Substance problems over time

### Within-Subjects Factors

Measure	time4	Dependent Variable
mrjuse	1	s2c1_3
	2	s2c1_6
	3	s2c1_9
	4	s2c1_12
problems	1	spsm_3
	2	spsm_6
	3	spsm_9
	4	spsm_12

Names the variables that represent each level of the within subjects factor.

### Between-Subjects Factors

		Value Label	N
xsite Site ID	100		112
	200		157
cond Condition (3 groups)	1.00	Inc arm, MCB5	92
	2.00	Inc arm, MC12	85
	3.00	Inc arm, FSNM	92
spsy2 median split on past year SPS	.00	low	146
	1.00	high	123

Number of cases for each level of the factor or factors used in the analysis.

**Descriptive Statistics**

Gives the MEAN, N and Standard Deviation for the WS Factors by condition, site and past year SPS. Display is after pivoting the table.

cond Condition (3 groups): 1.00 Inc arm, MCB5

	xsite Site ID	spsy2 median split PY SPS	s2c1_3 P90: Days of Marijuana Use - 3 months	s2c1_6 P90: Days of Marijuana Use - 6 months	s2c1_9 P90: Days of Marijuana Use - 9 months	s2c1_12 P90: Days of Marijuana Use - 12 months	spsm_3 Substance Problem Scale, past month - 3 months	spsm_6 Substance Problem Scale, past month - 6 months	spsm_9 Substance Problem Scale, past month - 9 months	spsm_12 Substance Problem Scale, past month - 12 months
Mean	100	.00 low	13.6111	10.2778	14.6111	12.8333	.7778	1.2778	1.3333	1.0556
		1.00 high	24.1667	42.2500	28.0833	28.6250	3.7500	4.3750	2.2500	2.6250
		Total	19.6429	28.5476	22.3095	21.8571	2.4762	3.0476	1.8571	1.9524
	200	.00 low	13.0313	22.3438	19.0313	16.0313	1.2500	1.2813	.8750	1.0000
		1.00 high	7.5000	12.3333	9.3333	16.5556	3.0556	1.6111	.8333	1.2222
		Total	11.0400	18.7400	15.5400	16.2200	1.9000	1.4000	.8600	1.0800
	Total	.00 low	13.2400	18.0000	17.4400	14.8800	1.0800	1.2800	1.0400	1.0200
		1.00 high	17.0238	29.4286	20.0476	23.4524	3.4524	3.1905	1.6429	2.0238
		Total	14.9674	23.2174	18.6304	18.7935	2.1630	2.1522	1.3152	1.4783
Std. Deviation	100	.00 low	22.81676	13.01947	19.38204	16.17278	1.35280	1.36363	2.08637	1.43372
		1.00 high	30.24489	33.13641	31.69133	33.75721	4.94535	4.50905	3.16571	3.53630
		Total	27.51303	30.70330	27.65333	28.46527	4.08590	3.81878	2.76363	2.91299
	200	.00 low	18.39966	27.70887	26.84662	24.32374	2.60273	2.43939	1.82721	1.48106
		1.00 high	10.25699	16.45672	14.39363	23.09118	4.31785	2.19997	1.42457	2.04524
		Total	16.05852	24.56130	23.45139	23.65077	3.39417	2.33867	1.67831	1.68838
	Total	.00 low	19.87159	24.05775	24.30853	21.62070	2.23004	2.09995	1.91620	1.44970
		1.00 high	25.02924	30.86726	27.15713	29.94809	4.64444	3.91519	2.63949	3.04028
		Total	22.32647	27.81526	25.53761	25.96597	3.71595	3.19318	2.28194	2.35563
N	100	.00 low	18	18	18	18	18	18	18	18
		1.00 high	24	24	24	24	24	24	24	24
		Total	42	42	42	42	42	42	42	42
	200	.00 low	32	32	32	32	32	32	32	32
		1.00 high	18	18	18	18	18	18	18	18
		Total	50	50	50	50	50	50	50	50
	Total	.00 low	50	50	50	50	50	50	50	50
		1.00 high	42	42	42	42	42	42	42	42
		Total	92	92	92	92	92	92	92	92

### Descriptive Statistics

Additional tables for the following condition groups are not presented as they follow the same format as the table above.

cond Condition (3 groups): 2.00 Inc arm, MC12

cond Condition (3 groups): 3.00 Inc arm, FSNM

cond Condition (3 groups): Total

### Box's Test of Equality of Covariance Matrices(a)

Box's M	1141.519
F	2.389
df1	396
df2	29740.07
	4
Sig.	.000

This is another test of sphericity done when there are multiple between-subjects variables in a model. As with Mauchly's test, you want this to be non-significant. Box's M is important if you plan to interpret the Multivariate Tests as opposed to the Univariate Tests. If the test is significant, use of Pillai's Trace is recommended.

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a Design: Intercept+s2c1\_0+spsm\_0+xsite+spsy2+cond(xsite)+ spsy2 \* cond(xsite)

Within Subjects Design: time4

This table lists various ways to examine the between- and within- subjects test and the interaction between the IV's and covariates -each with its own assumptions. The multivariate test examines the effects of the IV's on the combined dependent variables (mrjuse and problems). In this example, both baseline measures (marijuana use and substance problems), site, and the time by baseline substance problems interaction are significant..

### Multivariate Tests(d)

Effect			Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Between Subjects	Intercept	Pillai's Trace	.103	14.537(b)	2.000	254.000	.000	.103	29.074	.999
		Wilks' Lambda	.897	14.537(b)	2.000	254.000	.000	.103	29.074	.999
		Hotelling's Trace	.114	14.537(b)	2.000	254.000	.000	.103	29.074	.999
		Roy's Largest Root	.114	14.537(b)	2.000	254.000	.000	.103	29.074	.999
s2c1_0		Pillai's Trace	.056	7.601(b)	2.000	254.000	.001	.056	15.202	.944
		Wilks' Lambda	.944	7.601(b)	2.000	254.000	.001	.056	15.202	.944
		Hotelling's Trace	.060	7.601(b)	2.000	254.000	.001	.056	15.202	.944
		Roy's Largest Root	.060	7.601(b)	2.000	254.000	.001	.056	15.202	.944
spsm_0		Pillai's Trace	.103	14.657(b)	2.000	254.000	.000	.103	29.313	.999
		Wilks' Lambda	.897	14.657(b)	2.000	254.000	.000	.103	29.313	.999
		Hotelling's Trace	.115	14.657(b)	2.000	254.000	.000	.103	29.313	.999
		Roy's Largest Root	.115	14.657(b)	2.000	254.000	.000	.103	29.313	.999
xsite		Pillai's Trace	.035	4.627(b)	2.000	254.000	.011	.035	9.255	.778
		Wilks' Lambda	.965	4.627(b)	2.000	254.000	.011	.035	9.255	.778
		Hotelling's Trace	.036	4.627(b)	2.000	254.000	.011	.035	9.255	.778
		Roy's Largest Root	.036	4.627(b)	2.000	254.000	.011	.035	9.255	.778
spsy2		Pillai's Trace	.012	1.595(b)	2.000	254.000	.205	.012	3.190	.336
		Wilks' Lambda	.988	1.595(b)	2.000	254.000	.205	.012	3.190	.336
		Hotelling's Trace	.013	1.595(b)	2.000	254.000	.205	.012	3.190	.336
		Roy's Largest Root	.013	1.595(b)	2.000	254.000	.205	.012	3.190	.336

cond(xsite)	Pillai's Trace	.031	1.005	8.000	510.000	.431	.016	8.040	.472
	Wilks' Lambda	.969	1.005(b)	8.000	508.000	.431	.016	8.037	.472
	Hotelling's Trace	.032	1.004	8.000	506.000	.432	.016	8.033	.471
	Roy's Largest Root	.026	1.689(c)	4.000	255.000	.153	.026	6.756	.515
cond * spsy2(xsite)	Pillai's Trace	.055	1.447	10.000	510.000	.156	.028	14.467	.731
	Wilks' Lambda	.946	1.441(b)	10.000	508.000	.159	.028	14.415	.729
	Hotelling's Trace	.057	1.436	10.000	506.000	.161	.028	14.362	.727
	Roy's Largest Root	.033	1.662(c)	5.000	255.000	.144	.032	8.312	.573

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)	
Within Subjects	time4	Pillai's Trace	.033	1.432(b)	6.000	250.000	.203	.033	8.592	.553
		Wilks' Lambda	.967	1.432(b)	6.000	250.000	.203	.033	8.592	.553
		Hotelling's Trace	.034	1.432(b)	6.000	250.000	.203	.033	8.592	.553
		Roy's Largest Root	.034	1.432(b)	6.000	250.000	.203	.033	8.592	.553
time4 * s2c1_0	time4 * s2c1_0	Pillai's Trace	.016	.690(b)	6.000	250.000	.658	.016	4.141	.272
		Wilks' Lambda	.984	.690(b)	6.000	250.000	.658	.016	4.141	.272
		Hotelling's Trace	.017	.690(b)	6.000	250.000	.658	.016	4.141	.272
		Roy's Largest Root	.017	.690(b)	6.000	250.000	.658	.016	4.141	.272
time4 * spsm_0	time4 * spsm_0	Pillai's Trace	.064	2.834(b)	6.000	250.000	.011	.064	17.005	.883
		Wilks' Lambda	.936	2.834(b)	6.000	250.000	.011	.064	17.005	.883
		Hotelling's Trace	.068	2.834(b)	6.000	250.000	.011	.064	17.005	.883
		Roy's Largest Root	.068	2.834(b)	6.000	250.000	.011	.064	17.005	.883
time4 * xsite	time4 * xsite	Pillai's Trace	.044	1.938(b)	6.000	250.000	.075	.044	11.630	.709
		Wilks' Lambda	.956	1.938(b)	6.000	250.000	.075	.044	11.630	.709
		Hotelling's Trace	.047	1.938(b)	6.000	250.000	.075	.044	11.630	.709
		Roy's Largest Root	.047	1.938(b)	6.000	250.000	.075	.044	11.630	.709
time4 * spsy2	time4 * spsy2	Pillai's Trace	.026	1.090(b)	6.000	250.000	.369	.026	6.542	.428
		Wilks' Lambda	.974	1.090(b)	6.000	250.000	.369	.026	6.542	.428
		Hotelling's Trace	.026	1.090(b)	6.000	250.000	.369	.026	6.542	.428
		Roy's Largest Root	.026	1.090(b)	6.000	250.000	.369	.026	6.542	.428
time4 * cond (xsite)	time4 * cond (xsite)	Pillai's Trace	.121	1.313	24.000	1012.000	.144	.030	31.505	.935

time4 * cond * spsy2 (xsite)	Wilks' Lambda	.884	1.306	24.000	873.356	.149	.030	27.269	.882
	Hotelling's Trace	.125	1.297	24.000	994.000	.154	.030	31.127	.931
	Roy's Largest Root	.050	2.091(c)	6.000	253.000	.055	.047	12.544	.748
	Pillai's Trace	.145	1.264	30.000	1270.000	.155	.029	37.932	.961
	Wilks' Lambda	.861	1.269	30.000	1002.000	.153	.029	30.349	.891
	Hotelling's Trace	.154	1.271	30.000	1242.000	.150	.030	38.145	.962
	Roy's Largest Root	.073	3.094(c)	6.000	254.000	.006	.068	18.566	.913

a Computed using alpha = .05 b Exact statistic c The statistic is an upper bound on F that yields a lower bound on the significance level. d Design: Intercept+s2c1\_0+spsm\_0+xsite+spsy2+cond(xsite)+ spsy2 \* cond(xsite) Within Subjects Design: time4

This is a test of sphericity for within-subjects DV's. The preference for Mauchly's Test is that the result is NOT significant. In this example, it is significant for both marijuana use and substance problems, so one of the adjustments to the Univariate Within-Subjects Effects should be used.

#### Mauchly's Test of Sphericity(b)

Within Subjects Effect	Measure	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon(a)		
						Greenhouse-Geisser	Huynh-Feldt	Lower-bound
time4	mrjuse	.820	50.403	5	.000	.885	.941	.333
	problems	.872	34.689	5	.000	.915	.973	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b Design: Intercept+s2c1\_0+spsm\_0+xsite+spsy2+cond(xsite)+ spsy2 \* cond(xsite)

Within Subjects Design: time4

## Tests of Within-Subjects Effects

### Multivariate(d,e)

Within Subjects Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time4	Pillai's Trace	.012	1.580	6.000	1530.000	.149	.006	9.482	.614
	Wilks' Lambda	.988	1.578(b)	6.000	1528.000	.150	.006	9.471	.614
	Hotelling's Trace	.012	1.577	6.000	1526.000	.150	.006	9.460	.613
	Roy's Largest Root	.007	1.890(c)	3.000	765.000	.130	.007	5.669	.491
time4 * s2c1_0	Pillai's Trace	.005	.659	6.000	1530.000	.683	.003	3.955	.266
	Wilks' Lambda	.995	.659(b)	6.000	1528.000	.683	.003	3.953	.266
	Hotelling's Trace	.005	.659	6.000	1526.000	.683	.003	3.952	.266
	Roy's Largest Root	.005	1.214(c)	3.000	765.000	.304	.005	3.641	.327
time4 * spsm_0	Pillai's Trace	.026	3.419	6.000	1530.000	.002	.013	20.512	.945
	Wilks' Lambda	.974	3.429(b)	6.000	1528.000	.002	.013	20.573	.946
	Hotelling's Trace	.027	3.439	6.000	1526.000	.002	.013	20.634	.947
	Roy's Largest Root	.024	6.204(c)	3.000	765.000	.000	.024	18.612	.964
time4 * xsite	Pillai's Trace	.016	2.024	6.000	1530.000	.060	.008	12.143	.742
	Wilks' Lambda	.984	2.025(b)	6.000	1528.000	.059	.008	12.147	.742
	Hotelling's Trace	.016	2.025	6.000	1526.000	.059	.008	12.151	.742
	Roy's Largest Root	.013	3.329(c)	3.000	765.000	.019	.013	9.987	.758
time4 * spsy2	Pillai's Trace	.010	1.344	6.000	1530.000	.234	.005	8.062	.532
	Wilks' Lambda	.990	1.343(b)	6.000	1528.000	.235	.005	8.055	.532
	Hotelling's Trace	.011	1.342	6.000	1526.000	.235	.005	8.049	.532
	Roy's Largest Root	.008	1.952(c)	3.000	765.000	.120	.008	5.856	.505
time4 * cond ( xsite )	Pillai's Trace	.043	1.414	24.000	1530.000	.088	.022	33.948	.956
	Wilks' Lambda	.957	1.415(b)	24.000	1528.000	.088	.022	33.955	.956
	Hotelling's Trace	.045	1.415	24.000	1526.000	.088	.022	33.962	.956
	Roy's Largest Root	.031	1.948(c)	12.000	765.000	.026	.030	23.376	.918
time4 * spsy2 * cond ( xsite )	Pillai's Trace	.050	1.320	30.000	1530.000	.116	.025	39.591	.970
	Wilks' Lambda	.950	1.319(b)	30.000	1528.000	.116	.025	39.584	.970

Hotelling's Trace	.052	1.319	30.000	1526.000	.116	.025	39.578	.970
Roy's Largest Root	.034	1.721(c)	15.000	765.000	.042	.033	25.810	.925

a Computed using alpha = .05

b Exact statistic

c The statistic is an upper bound on F that yields a lower bound on the significance level.

d Design: Intercept+s2c1\_0+spsm\_0+xsite+spsy2+cond(xsite)+ spsy2 \* cond(xsite)

Within Subjects Design: time4

e Tests are based on averaged variables.

Since sphericity is not assumed (i.e., Mauchly's Test is significant), use the Huynh-Feldt, adjustment row (highlighted) to determine effects. In this example, there are 2 significant interaction effects for problems and one for marijuana use. There are no significant main effects.

#### Univariate Tests

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)	
time4	mrjuse	Sphericity Assumed	2001.634	3	667.211	1.890	.130	.007	5.669	.491
		Greenhouse-Geisser	2001.634	2.655	753.999	1.890	.137	.007	5.016	.459
		Huynh-Feldt	2001.634	2.822	709.302	1.890	.134	.007	5.332	.474
		Lower-bound	2001.634	1.000	2001.634	1.890	.170	.007	1.890	.278
	problems	Sphericity Assumed	18.271	3	6.090	1.385	.246	.005	4.156	.370
		Greenhouse-Geisser	18.271	2.745	6.655	1.385	.248	.005	3.804	.352
		Huynh-Feldt	18.271	2.920	6.258	1.385	.247	.005	4.045	.364
		Lower-bound	18.271	1.000	18.271	1.385	.240	.005	1.385	.216
time4 * s2c1_0	mrjuse	Sphericity Assumed	297.131	3	99.044	.280	.840	.001	.841	.104
		Greenhouse-Geisser	297.131	2.655	111.927	.280	.815	.001	.745	.101
		Huynh-Feldt	297.131	2.822	105.292	.280	.828	.001	.792	.102
		Lower-bound	297.131	1.000	297.131	.280	.597	.001	.280	.082
	problems	Sphericity Assumed	15.970	3	5.323	1.211	.305	.005	3.633	.326
		Greenhouse-Geisser	15.970	2.745	5.817	1.211	.304	.005	3.325	.311
		Huynh-Feldt	15.970	2.920	5.470	1.211	.305	.005	3.536	.322

time4 * spsm_0	mrjuse	Lower-bound	15.970	1.000	15.970	1.211	.272	.005	1.211	.195
		Sphericity Assumed	1439.964	3	479.988	1.359	.254	.005	4.078	.363
		Greenhouse-Geisser	1439.964	2.655	542.422	1.359	.256	.005	3.609	.340
		Huynh-Feldt	1439.964	2.822	510.268	1.359	.255	.005	3.836	.351
	problems	Lower-bound	1439.964	1.000	1439.964	1.359	.245	.005	1.359	.213
		Sphericity Assumed	81.097	3	27.032	6.149	.000	.024	18.448	.962
		Greenhouse-Geisser	81.097	2.745	29.539	6.149	.001	.024	16.882	.950
		Huynh-Feldt	81.097	2.920	27.776	6.149	.000	.024	17.954	.959
time4 * xsite	mrjuse	Lower-bound	81.097	1.000	81.097	6.149	.014	.024	6.149	.695
		Sphericity Assumed	2833.008	3	944.336	2.674	.046	.010	8.023	.653
		Greenhouse-Geisser	2833.008	2.655	1067.170	2.674	.053	.010	7.100	.614
		Huynh-Feldt	2833.008	2.822	1003.910	2.674	.050	.010	7.547	.633
	problems	Lower-bound	2833.008	1.000	2833.008	2.674	.103	.010	2.674	.371
		Sphericity Assumed	9.822	3	3.274	.745	.526	.003	2.234	.210
		Greenhouse-Geisser	9.822	2.745	3.578	.745	.515	.003	2.045	.202
		Huynh-Feldt	9.822	2.920	3.364	.745	.522	.003	2.175	.208
time4 * spsy2	mrjuse	Lower-bound	9.822	1.000	9.822	.745	.389	.003	.745	.138
		Sphericity Assumed	2066.449	3	688.816	1.951	.120	.008	5.852	.505
		Greenhouse-Geisser	2066.449	2.655	778.414	1.951	.128	.008	5.179	.472
		Huynh-Feldt	2066.449	2.822	732.271	1.951	.124	.008	5.505	.488
	problems	Lower-bound	2066.449	1.000	2066.449	1.951	.164	.008	1.951	.285
		Sphericity Assumed	13.234	3	4.411	1.004	.391	.004	3.011	.274
		Greenhouse-Geisser	13.234	2.745	4.821	1.004	.386	.004	2.755	.262
		Huynh-Feldt	13.234	2.920	4.533	1.004	.389	.004	2.930	.270
time4 * cond ( xsite )	mrjuse	Lower-bound	13.234	1.000	13.234	1.004	.317	.004	1.004	.170
		Sphericity Assumed	6698.758	12	558.230	1.581	.092	.024	18.971	.837
		Greenhouse-Geisser	6698.758	10.619	630.841	1.581	.103	.024	16.787	.799
		Huynh-Feldt	6698.758	11.288	593.446	1.581	.097	.024	17.845	.818
	problems	Lower-bound	6698.758	4.000	1674.689	1.581	.180	.024	6.324	.485
		Sphericity Assumed	90.582	12	7.548	1.717	.059	.026	20.606	.873
		Greenhouse-Geisser	90.582	10.982	8.249	1.717	.066	.026	18.857	.848

time4 * spsy2 * cond ( xsite )	mrjuse	Huynh-Feldt	90.582	11.679	7.756	1.717	.061	.026	20.054	.865
		Lower-bound	90.582	4.000	22.645	1.717	.147	.026	6.869	.522
		Sphericity Assumed	6030.336	15	402.022	1.139	.317	.022	17.078	.740
		Greenhouse-Geisser	6030.336	13.273	454.315	1.139	.322	.022	15.112	.698
		Huynh-Feldt	6030.336	14.110	427.384	1.139	.319	.022	16.064	.719
	problems	Lower-bound	6030.336	5.000	1206.067	1.139	.340	.022	5.693	.403
		Sphericity Assumed	113.039	15	7.536	1.714	.044	.033	25.714	.924
		Greenhouse-Geisser	113.039	13.727	8.235	1.714	.050	.033	23.532	.904
		Huynh-Feldt	113.039	14.599	7.743	1.714	.045	.033	25.026	.918
		Lower-bound	113.039	5.000	22.608	1.714	.132	.033	8.571	.588
Error(time4)	mrjuse	Sphericity Assumed	270130.872	765	353.112					
		Greenhouse-Geisser	270130.872	676.946	399.043					
		Huynh-Feldt	270130.872	719.604	375.388					
		Lower-bound	270130.872	255.000	1059.337					
		Sphericity Assumed	3362.891	765	4.396					
	problems	Greenhouse-Geisser	3362.891	700.074	4.804					
		Huynh-Feldt	3362.891	744.526	4.517					
		Lower-bound	3362.891	255.000	13.188					

a Computed using alpha = .05

The test of within-subjects contrasts identifies the shape of the distribution of the DV over levels of the within-subjects factor (i.e., time). In this example, there are interactions with significant linear, quadratic, and cubic relationships for time by substance problems at intake for substance problems, for time by site for marijuana use and time by past year problems for marijuana use.

### Tests of Within-Subjects Contrasts

Source	Measure	time4	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
time4	mrjuse	Linear	1859.955	1	1859.955	3.690	.056	.014	3.690	.482
		Quadratic	141.448	1	141.448	.442	.507	.002	.442	.102
		Cubic	.231	1	.231	.001	.975	.000	.001	.050
	problems	Linear	4.138	1	4.138	.709	.401	.003	.709	.134
		Quadratic	.920	1	.920	.239	.625	.001	.239	.078
		Cubic	13.213	1	13.213	3.768	.053	.015	3.768	.490
time4 * s2c1_0	mrjuse	Linear	266.095	1	266.095	.528	.468	.002	.528	.112
		Quadratic	19.613	1	19.613	.061	.805	.000	.061	.057
		Cubic	11.424	1	11.424	.049	.826	.000	.049	.056
	problems	Linear	6.541	1	6.541	1.121	.291	.004	1.121	.184
		Quadratic	8.972	1	8.972	2.334	.128	.009	2.334	.331
		Cubic	.457	1	.457	.130	.719	.001	.130	.065
time4 * spsm_0	mrjuse	Linear	806.791	1	806.791	1.600	.207	.006	1.600	.243
		Quadratic	338.534	1	338.534	1.059	.304	.004	1.059	.176
		Cubic	294.639	1	294.639	1.251	.264	.005	1.251	.200
	problems	Linear	51.040	1	51.040	8.744	.003	.033	8.744	.838
		Quadratic	25.891	1	25.891	6.736	.010	.026	6.736	.734
		Cubic	4.166	1	4.166	1.188	.277	.005	1.188	.192
time4 * xsite	mrjuse	Linear	2145.112	1	2145.112	4.255	.040	.016	4.255	.538
		Quadratic	554.826	1	554.826	1.736	.189	.007	1.736	.259
		Cubic	133.070	1	133.070	.565	.453	.002	.565	.116
	problems	Linear	.089	1	.089	.015	.902	.000	.015	.052

		Quadratic	2.416	1	2.416	.629	.429	.002	.629	.124
		Cubic	7.317	1	7.317	2.087	.150	.008	2.087	.302
time4 * spsy2	mrjuse	Linear	1744.307	1	1744.307	3.460	.064	.013	3.460	.458
		Quadratic	258.920	1	258.920	.810	.369	.003	.810	.146
		Cubic	63.222	1	63.222	.268	.605	.001	.268	.081
	problems	Linear	4.551	1	4.551	.780	.378	.003	.780	.142
		Quadratic	4.228	1	4.228	1.100	.295	.004	1.100	.181
		Cubic	4.455	1	4.455	1.271	.261	.005	1.271	.202
time4 * cond ( xsite )	mrjuse	Linear	2534.126	4	633.531	1.257	.288	.019	5.027	.391
		Quadratic	1961.540	4	490.385	1.534	.193	.023	6.136	.472
		Cubic	2203.093	4	550.773	2.338	.056	.035	9.354	.673
	problems	Linear	38.987	4	9.747	1.670	.157	.026	6.679	.510
		Quadratic	37.026	4	9.256	2.408	.050	.036	9.632	.688
		Cubic	14.569	4	3.642	1.039	.388	.016	4.155	.326
time4 * spsy2 * cond ( xsite )	mrjuse	Linear	322.043	5	64.409	.128	.986	.002	.639	.079
		Quadratic	2968.181	5	593.636	1.857	.102	.035	9.285	.628
		Cubic	2740.111	5	548.022	2.327	.043	.044	11.634	.743
	problems	Linear	50.358	5	10.072	1.725	.129	.033	8.627	.591
		Quadratic	41.602	5	8.320	2.165	.059	.041	10.823	.707
		Cubic	21.078	5	4.216	1.202	.309	.023	6.011	.425
Error(time4)	mrjuse	Linear	128550.476	255	504.120					
		Quadratic	81519.904	255	319.686					
		Cubic	60060.492	255	235.531					
	problems	Linear	1488.550	255	5.837					
		Quadratic	980.208	255	3.844					
		Cubic	894.133	255	3.506					

a Computed using alpha = .05

Levene's Test assumes error variances for each within-subjects DV are equal across levels of the between-subjects grouping variable. This assumption is important for interpretation of the between-subjects effects. As with Mauchly's Test and Box's M, Levene's test should be non-significant. In this example, all tests are significant, indicating violation of this assumption. However, ANOVA is fairly robust to violations of this assumption.

#### Levene's Test of Equality of Error Variances(a)

	F	df1	df2	Sig.
s2c1_3 P90: Days of Marijuana Use - 3 months	3.074	11	257	.001
s2c1_6 P90: Days of Marijuana Use - 6 months	3.021	11	257	.001
s2c1_9 P90: Days of Marijuana Use - 9 months	2.589	11	257	.004
s2c1_12 P90: Days of Marijuana Use - 12 months	1.964	11	257	.032
spsm_3 Substance Problem index, past month - 3 months	3.733	11	257	.000
spsm_6 Substance Problem index, past month - 6 months	4.612	11	257	.000
spsm_9 Substance Problem index, past month - 9 months	3.467	11	257	.000
spsm_12 Substance Problem index, past month - 12 months	7.622	11	257	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+s2c1\_0+spsm\_0+xsite+spsy2+cond(xsite)+ spsy2 \* cond(xsite)

Within Subjects Design: time4

The Tests of Between-Subjects Effects in a repeated measures analysis of variance are interpreted the same way as in a standard ANOVA. In this example, there is a significant main effect of baseline days of marijuana use on days of use at follow-up. There are also significant main effects of baseline substance problems and of site on substance problems at follow-up. There are no significant interactions.

### Tests of Between-Subjects Effects

Transformed Variable: Average

Source	Measure	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power(a)
Intercept	mrjuse	37590.640	1	37590.640	26.582	.000	.094	26.582	.999
	problems	268.545	1	268.545	19.180	.000	.070	19.180	.992
s2c1_0	mrjuse	18225.339	1	18225.339	12.888	.000	.048	12.888	.947
	problems	11.724	1	11.724	.837	.361	.003	.837	.149
spsm_0	mrjuse	3700.253	1	3700.253	2.617	.107	.010	2.617	.364
	problems	366.470	1	366.470	26.174	.000	.093	26.174	.999
xsite	mrjuse	1911.331	1	1911.331	1.352	.246	.005	1.352	.212
	problems	122.092	1	122.092	8.720	.003	.033	8.720	.837
spsy2	mrjuse	336.014	1	336.014	.238	.626	.001	.238	.077
	problems	39.100	1	39.100	2.793	.096	.011	2.793	.384
cond(xsite)	mrjuse	2320.756	4	580.189	.410	.801	.006	1.641	.145
	problems	82.875	4	20.719	1.480	.209	.023	5.919	.456
spsy2 * cond(xsite)	mrjuse	9032.483	5	1806.497	1.277	.274	.024	6.387	.450
	problems	113.518	5	22.704	1.622	.155	.031	8.108	.560
Error	mrjuse	360601.76	255	1414.125					
	problems	3570.297	255	14.001					

a. Computed using alpha = .05

The partial eta squared in the parameter estimates table can be used to determine which levels of which factors are contributing the most to the model

### Parameter Estimates

Dependent Variable: s2c1\_3 P90: Days of Marijuana Use - 3 months

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared	Noncent. Parameter	Observed Power(a)
					Lower Bound	Upper Bound			
Intercept	-5.559	5.554	-1.001	.318	-16.497	5.378	.004	1.001	.169
s2c1_0	.210	.062	3.370	.001	.087	.332	.043	3.370	.919
spsm_0	1.358	.555	2.448	.015	.266	2.451	.023	2.448	.684
[xsite=100]	18.769	6.555	2.863	.005	5.860	31.679	.031	2.863	.814
[xsite=200]	0(b)	.	.	.	.	.	.	.	.
[spsy2=.00]	14.631	6.297	2.324	.021	2.231	27.032	.021	2.324	.639
[spsy2=1.00]	0(b)	.	.	.	.	.	.	.	.
[cond=1.00]([xsite=100])	-9.799	6.614	-1.481	.140	-22.825	3.227	.009	1.481	.314
[cond=2.00]([xsite=100])	5.645	7.014	.805	.422	-8.167	19.457	.003	.805	.126
[cond=3.00]([xsite=100])	0(b)	.	.	.	.	.	.	.	.
[cond=1.00]([xsite=200])	1.670	7.014	.238	.812	-12.144	15.483	.000	.238	.056
[cond=2.00]([xsite=200])	12.318	7.354	1.675	.095	-2.164	26.800	.011	1.675	.386
[cond=3.00]([xsite=200])	0(b)	.	.	.	.	.	.	.	.
[spsy2=.00] * [cond=1.00] ([xsite=100])	-11.055	9.201	-1.201	.231	-29.175	7.065	.006	1.201	.224
[spsy2=1.00] * [cond=1.00] ([xsite=100])	0(b)	.	.	.	.	.	.	.	.
[spsy2=.00] * [cond=2.00] ([xsite=100])	-18.134	9.550	-1.899	.059	-36.941	.673	.014	1.899	.473
[spsy2=1.00] * [cond=2.00] ([xsite=100])	0(b)	.	.	.	.	.	.	.	.
[spsy2=.00] * [cond=3.00] ([xsite=100])	-14.929	9.998	-1.493	.137	-34.620	4.761	.009	1.493	.319
[spsy2=1.00] * [cond=3.00] ([xsite=100])	0(b)	.	.	.	.	.	.	.	.

[cond=3.00] ([xsite=100])

[spsy2=.00] *	-4.660	8.940	-.521	.603	-22.266	12.946	.001	.521	.081
[cond=1.00] ([xsite=200])									
[spsy2=1.00] *	0(b)	.	.	.	.	.	.	.	.
[cond=1.00] ([xsite=200])									
[spsy2=.00] *	-15.670	9.176	-1.708	.089	-33.741	2.401	.011	1.708	.398
[cond=2.00] ([xsite=200])									
[spsy2=1.00] *	0(b)	.	.	.	.	.	.	.	.
[cond=2.00] ([xsite=200])									
[spsy2=.00] *	0(b)	.	.	.	.	.	.	.	.
[cond=3.00] ([xsite=200])									
[spsy2=1.00] *	0(b)	.	.	.	.	.	.	.	.
[cond=3.00] ([xsite=200])									

a Computed using alpha = .05

b This parameter is set to zero because it is redundant.

### Parameter Estimates

Additional tables for the following condition groups are not presented as they follow the same format as the table above.

Dependent Variable: s2c1\_6 P90: Days of Marijuana Use - 6 months

a Computed using alpha = .05

b This parameter is set to zero because it is redundant.

Dependent Variable: s2c1\_9 P90: Days of Marijuana Use - 9 months

a Computed using alpha = .05

b This parameter is set to zero because it is redundant.

Dependent Variable: s2c1\_12 P90: Days of Marijuana Use - 12 months

a Computed using alpha = .05

b This parameter is set to zero because it is redundant.

### Parameter Estimates

Dependent Variable: spsm\_3 Substance Problem Scale, past month - 3 months

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared	Noncent. Parameter	Observed Power(a)
					Lower Bound	Upper Bound			
Intercept	-.611	.684	-.893	.373	-1.958	.736	.003	.893	.144
s2c1_0	.005	.008	.645	.519	-.010	.020	.002	.645	.098
spsm_0	.430	.068	6.297	.000	.296	.565	.135	6.297	1.000
[xsite=100]	1.010	.807	1.252	.212	-.579	2.600	.006	1.252	.239
[xsite=200]	0(b)	.	.	.	.	.	.	.	.
[spsy2=.00]	.927	.775	1.196	.233	-.600	2.454	.006	1.196	.222
[spsy2=1.00]	0(b)	.	.	.	.	.	.	.	.
[cond=1.00]([xsite=100])	.157	.815	.193	.847	-1.447	1.761	.000	.193	.054
[cond=2.00]([xsite=100])	2.637	.864	3.053	.003	.936	4.338	.035	3.053	.860
[cond=3.00]([xsite=100])	0(b)	.	.	.	.	.	.	.	.
[cond=1.00]([xsite=200])	1.695	.864	1.962	.051	-.006	3.396	.015	1.962	.498
[cond=2.00]([xsite=200])	.195	.906	.215	.830	-1.589	1.978	.000	.215	.055
[cond=3.00]([xsite=200])	0(b)	.	.	.	.	.	.	.	.
[spsy2=.00] *									
[cond=1.00]([xsite=100])	-1.681	1.133	-1.483	.139	-3.912	.551	.009	1.483	.315
[spsy2=1.00] *									
[cond=1.00]([xsite=100])	0(b)	.	.	.	.	.	.	.	.
[spsy2=.00] *									
[cond=2.00]([xsite=100])	-3.145	1.176	-2.674	.008	-5.461	-.829	.027	2.674	.759
[spsy2=1.00] *									
[cond=2.00]([xsite=100])	0(b)	.	.	.	.	.	.	.	.
[spsy2=.00] *									
[cond=3.00]([xsite=100])	.321	1.231	.260	.795	-2.104	2.745	.000	.260	.058
[spsy2=1.00] *									
[cond=3.00]([xsite=100])	0(b)	.	.	.	.	.	.	.	.

[spsy2=.00] *									
[cond=1.00]	-1.647	1.101	-1.496	.136	-3.815	.521	.009	1.496	.319
([xsite=200])									
[spsy2=1.00] *									
[cond=1.00]	0(b)	.	.	.	.	.	.	.	.
([xsite=200])									
[spsy2=.00] *									
[cond=2.00]	.407	1.130	.360	.719	-1.818	2.633	.001	.360	.065
([xsite=200])									
[spsy2=1.00] *									
[cond=2.00]	0(b)	.	.	.	.	.	.	.	.
([xsite=200])									
[spsy2=.00] *									
[cond=3.00]	0(b)	.	.	.	.	.	.	.	.
([xsite=200])									
[spsy2=1.00] *									
[cond=3.00]	0(b)	.	.	.	.	.	.	.	.
([xsite=200])									

a Computed using alpha = .05

b This parameter is set to zero because it is redundant.

### Parameter Estimates

Additional tables for the following condition groups are not presented as they follow the same format as the table above.

Dependent Variable: spsm\_6 Substance Problem index, past month - 6 months

a Computed using alpha = .05

b This parameter is set to zero because it is redundant.

Dependent Variable: spsm\_9 Substance Problem index, past month - 9 months

a Computed using alpha = .05

b This parameter is set to zero because it is redundant.

**Comments:** In addition to reporting significance levels, we recommend calculating and reporting effect sizes when a model has both within and between subjects factors (like the one used in Example 2). Cohen's  $f$  index should be used when there are more than two levels of the independent variable. Effect size is of the greatest interest for the interaction terms involving the within and between subjects variables. Partial eta squared is used to calculate Cohen's  $f$ :

$$f = \sqrt{(\text{partial eta squared}/(1 - \text{partial eta squared}))}$$

**Describing These Procedures:** These procedures would normally be described:

For Example 1:

*A repeated measures analysis of variance using GLM was run at 3, 6, 9, and 12 month follow-up on days of marijuana use (S2c1). The baseline clinical measure of marijuana use was included as a covariate to allow for individual differences. Results indicated that marijuana use was significantly related to time,  $F(3, 1423) = 3.49, p < .05$ . As expected, marijuana use at intake was significantly related to follow-up marijuana use,  $F(1, 532) = 73.43, p < .001$ .*

*The baseline clinical measures [marijuana use and past month substance problems] were included as covariates to allow for individual differences. Reflecting the randomized block design, conditions were modeled as nested within site, which produces a statistic for the significance of site effects, conditions across site effects, and conditions within site effects. (from Dennis, Godley, et al., 2004, p. 206)*

*A repeated measures analysis of variance was run at intake and 3, 6, 9, and 12 month follow-up on days of marijuana use (S2c1) and past month substance problems (SPSm) for each of the variables listed above. Even though there were few significant interactions, due to the small sample size, we examined the effect sizes. Because of multiple means involved in testing the interaction, the  $f$ -index (Cohen, 1988) was used. The  $f$  index is based on the partial eta square from the interaction. Interpretation of an  $f$  is 0.10 for a small effect, 0.25 for a medium effect and 0.40 for a large effect. These  $f$ 's are reported in <indicate where you report  $f$ 's> for the interactions of time with each of the between-subjects variables. They fall in the range of .033 to .183, which are small to moderate effects. Conditions nested within sites appear to have the largest effects on the outcomes. Baseline marijuana use had little to no effect on outcomes.*

## Annotated Bibliography

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

This book is a guide to power analysis for research planning geared toward users of applied statistics.

Dennis, M. L., Godley, S. H., Diamond, G., Tims, F. M., Babor, T., Donaldson, J., Liddle, H., et al. (2004). The Cannabis Youth Treatment (CYT) study: Main findings from two randomized trials. *Journal of Substance Abuse Treatment*, 27, 197–213.

This is the CYT main findings article where a mixed model analysis is reported in the appendix.

Statistical Program for the Social Sciences (SPSS 2008). *SPSS Advanced Statistics 17.0*. Chicago, IL: Author  
(<http://support.spss.com/ProductsExt/SPSS/ESD/17/Download/User%20Manuals/English/SPSS%20Advanced%20Statistics%2017.0.pdf>)

Statistical Program for the Social Sciences (SPSS 2008). *SPSS Base 17.0 User's Guide*. Chicago, IL: Author  
(<http://support.spss.com/ProductsExt/SPSS/ESD/17/Download/User%20Manuals/English/SPSS%20Statistcs%20Base%20User's%20Guide%2017.0.pdf>).

These are the most recent SPSS manuals available online describing the procedures for GLM Repeated Measures. In earlier versions, this procedure could be found under MANOVA

SPSS. (2008). *Statistical program for the social sciences, version 17*. Chicago, IL: SPSS.  
([www.spss.com](http://www.spss.com))

This is the citation for the program being used. Note that SPSS Version 17 was purchased by IBM and the name was changed to PASW (Predictive Analytic SoftWare).

Statistical Program for the Social Sciences (SPSS 1999). *SPSS Training: Advanced Statistical Analysis Using SPSS*. Chicago, IL: Author ([www.spss.com](http://www.spss.com)).

SPSS's Training manual. This gives specific examples of how and when to use GLM Repeated Measures.

Vogt, W. Paul. (1999). *Dictionary of Statistics & Methodology: A nontechnical guide for the social sciences (Edition 2)*. Thousand Oaks, CA: SAGE Publications, Inc.

This dictionary gives clear and understandable definitions of key terms specific to Repeated Measures.