

Repeated Measure Two factors repeat on one (ISI) Sept 2, 2004

Compound CS vs UN

The SAS System

20:04 Thursday, July 17, 2003 325

Covariance structures

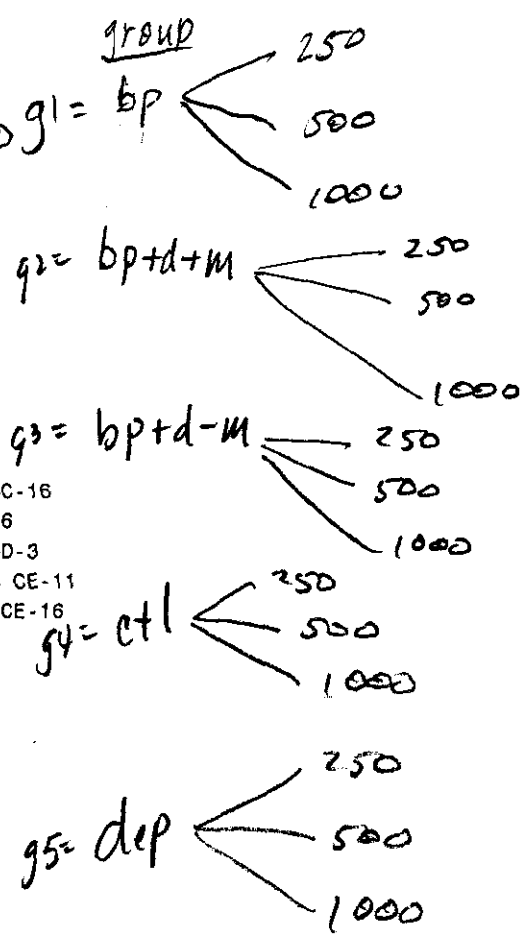
The Mixed Procedure

Model Information

Data Set EDGAR.AEP_HEP
 Dependent Variable Hab
 Covariance Structure Compound Symmetry
 Subject Effect Subject
 Estimation Method REML
 Residual Variance Method Profile
 Fixed Effects SE Method Model-Based
 Degrees of Freedom Method Between-Within

Class Level Information

Class	Levels	Values		
Subject	86	CC-1 CC-11 CC-12 CC-14 CC-16		
		CC-2 CC-3 CC-4 CC-5B CC-6		
		CD-11 CD-12 CD-14 CD-2 CD-3		
		CD-4 CD-5 CD-6 CD-7 CD-8 CE-11		
		CE-12 CE-13 CE-14 CE-15 CE-16		
		CE-4 CE-7 CE-8 CE-9 CE-7		
		CLBP-01 CLBP-02 CLBP-03		
		CLBP-05 CLBP-06 CLBP-07		
		CLBP-08 CLBP-09 CLBP-10		
		CLBP-11 CLBP-12 CLBP-13		
		CLBP-14 CLBP-15 CLBP-16		
		CLBP-17 CLBP-19 CLBP-20		
		CLBP-21 CLBP-22 CLBP-23		
		CLBP-24 CLBP-25 CLBP-26		
		CLBP-27 CLBP-28 CLBP-29		
		CLBP-30 CLBP-31 CLBP-32		
		CLBP-33 CLBP-34 CLBP-35		
		CLBP-36 CLBP-37 CLBP-38		
		CLBP-39 CLBP-40 CLBP-41		
		CLBP-42 CLBP-43 CLBP-45		
		CLBP-46 DEP-1 DEP-2 DEP-3		
		DEP-4 DEP-5 DEP-6 JRS POW-10		
		POW-6 R-113 R-201 R-205		
		ISI	3	250 500 1000
		group	5	bp bp+d+m bp+d-m ctl dep



Dimensions

<u>Covariance Parameters</u>	2
Columns in X	24
Columns in Z	0
Subjects	86
Max Obs Per Subject	3
Observations Used	240



The Mixed Procedure

Dimensions

Observations Not Used 18
Total Observations 258

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	2128.77358721	
1	2	2108.15753019	0.00000106
2	1	2108.15662450	0.00000000

Convergence criteria met.

Estimated ^{Cov} Matrix for Subject CC-1

Row	Col1	Col2	Col3
1	631.87	200.96	200.96
2	200.96	631.87	200.96
3	200.96	200.96	631.87

put this $\frac{1}{2}$ on the diagonal in prev page.

Estimated R Correlation Matrix for Subject CC-1

Row	Col1	Col2	Col3
1	1.0000	0.3180	0.3180
2	0.3180	1.0000	0.3180
3	0.3180	0.3180	1.0000

Covariance Parameter Estimates

Cov Parm	Subject	Estimate
CS	Subject	200.96
Residual		430.91

Fit Statistics

-2 Res Log Likelihood	2108.2
AIC (smaller is better)	2112.2
AICC (smaller is better)	2112.2
BIC (smaller is better)	2117.1

The Mixed Procedure

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
1	20.62	<.0001

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
group	4	80	2.25	0.0706
ISI	2	145	73.46	<.0001
ISI*group	8	145	3.75	0.0005

Unbalanced experiment but roughly well for each of these

$$\hat{\sigma}^2 = \frac{631}{87}$$

$$\hat{\sigma} = \sqrt{\frac{631}{87}} = \sqrt{7.25} \approx 2.69$$

Note F = 3.75 this comes up later.

Conclude interaction present \rightarrow The difference in groups depends on ISI level.

Least Squares Means Standard Error

Effect	group	ISI	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
ISI*group	bp	250	10.8123	5.3592	145	2.02	0.0455	0.05	0.2200	21.4046
ISI*group	bp+d+m	250	8.4863	8.8873	145	0.95	0.3412	0.05	-9.0791	26.0516
ISI*group	bp+d-m	250	5.2467	7.2564	145	0.72	0.4708	0.05	-9.0953	19.5887
ISI*group	ctl	250	17.2784	4.1325	145	4.18	<.0001	0.05	9.1107	25.4461
ISI*group	dep	250	43.6667	10.2621	145	4.26	<.0001	0.05	23.3840	63.9493
ISI*group	bp	500	48.3574	5.8422	145	8.28	<.0001	0.05	36.8106	59.9042
ISI*group	bp+d+m	500	34.2400	8.8873	145	3.85	0.0002	0.05	16.6747	51.8053
ISI*group	bp+d-m	500	66.6983	7.5471	145	8.84	<.0001	0.05	51.7818	81.6148
ISI*group	ctl	500	36.5968	4.2313	145	8.65	<.0001	0.05	28.2338	44.9597
ISI*group	dep	500	65.1667	10.2621	145	6.35	<.0001	0.05	44.8840	85.4493
ISI*group	bp	1000	60.5551	5.5817	145	10.85	<.0001	0.05	49.5230	71.5871
ISI*group	bp+d+m	1000	55.4850	9.4093	145	5.90	<.0001	0.05	36.8879	74.0821
ISI*group	bp+d-m	1000	82.6486	8.2319	145	10.04	<.0001	0.05	66.3786	98.9186
ISI*group	ctl	1000	67.8427	4.1808	145	16.23	<.0001	0.05	59.5795	76.1059
ISI*group	dep	1000	61.5732	11.0969	145	5.55	<.0001	0.05	39.6407	83.5058

Most of these are around 6 depending on ISI

We should focus on simple effects, that is, the difference among groups

Tests of Effect Slices

Effect	ISI	Num DF	Den DF	F Value	Pr > F
ISI*group	250	4	145	2.77	0.0297
ISI*group	500	4	145	4.46	0.0020
ISI*group	1000	4	145	1.66	0.1625

Keeping ISI fixed (or maybe vice-versa if that was of interest),

The Mixed Procedure

Model Information

Data Set	EDGAR.AEP_HEP
Dependent Variable	Hab__
Covariance Structure	Unstructured
Subject Effect	Subject
Estimation Method	REML
Residual Variance Method	None
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Between-Within

Class Level Information

Class	Levels	Values
Subject	86	CC-1 CC-11 CC-12 CC-14 CC-16 CC-2 CC-3 CC-4 CC-5B CC-6 CD-11 CD-12 CD-14 CD-2 CD-3 CD-4 CD-5 CD-6 CD-7 CD-8 CE-11 CE-12 CE-13 CE-14 CE-15 CE-16 CE-4 CE-7 CE-8 CE-9 CE-? CLBP-01 CLBP-02 CLBP-03 CLBP-05 CLBP-06 CLBP-07 CLBP-08 CLBP-09 CLBP-10 CLBP-11 CLBP-12 CLBP-13 CLBP-14 CLBP-15 CLBP-16 CLBP-17 CLBP-19 CLBP-20 CLBP-21 CLBP-22 CLBP-23 CLBP-24 CLBP-25 CLBP-26 CLBP-27 CLBP-28 CLBP-29 CLBP-30 CLBP-31 CLBP-32 CLBP-33 CLBP-34 CLBP-35 CLBP-36 CLBP-37 CLBP-38 CLBP-39 CLBP-40 CLBP-41 CLBP-42 CLBP-43 CLBP-45 CLBP-46 DEP-1 DEP-2 DEP-3 DEP-4 DEP-5 DEP-6 JRS POW-10 POW-6 R-113 R-201 R-205
ISI	3	250 500 1000
group	5	bp bp+d+m bp+d-m ctl dep

Dimensions

Covariance Parameters	6
Columns in X	24
Columns in Z	0
Subjects	86
Max Obs Per Subject	3
Observations Used	240

The Mixed Procedure

Dimensions

Observations Not Used 18
Total Observations 258

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	2128.77358721	
1	2	2073.74267755	0.00000051
2	1	2073.74225481	0.00000000

Convergence criteria met.

Covariance
Estimated R Matrix for Subject CC-1

Row	Col1	Col2	Col3
1	282.86	147.03	91.2642
2	147.03	684.60	389.58
3	91.2642	389.58	967.09

Put this on diagonal

Estimated R Correlation Matrix for Subject CC-1

Row	Col1	Col2	Col3
1	1.0000	0.3341	0.1745
2	0.3341	1.0000	0.4788
3	0.1745	0.4788	1.0000

Test diff in covariance structures

Covariance Parameter Estimates

Cov Parm	Subject	Estimate
UN(1,1)	Subject	282.86
UN(2,1)	Subject	147.03
UN(2,2)	Subject	684.60
UN(3,1)	Subject	91.2642
UN(3,2)	Subject	389.58
UN(3,3)	Subject	967.09

type -2 ln # of parameters
UN 2073.7 6
CS 2108.2 2

$\chi^2 = 2108.2 - 2073.7 = 34.5$
 $df = 6 - 2 = 4$
} $p < .05$, conclude unstructured gives a gain over CS structure

The Mixed Procedure

Fit Statistics

-2 Res Log Likelihood	2073.7
AIC (smaller is better)	2085.7
AICC (smaller is better)	2086.1
BIC (smaller is better)	2100.5

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
5	55.03	<.0001

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
group	4	80	2.00	0.1032
ISI	2	80	66.37	<.0001
ISI*group	8	80	4.08	0.0004

Least Squares Means

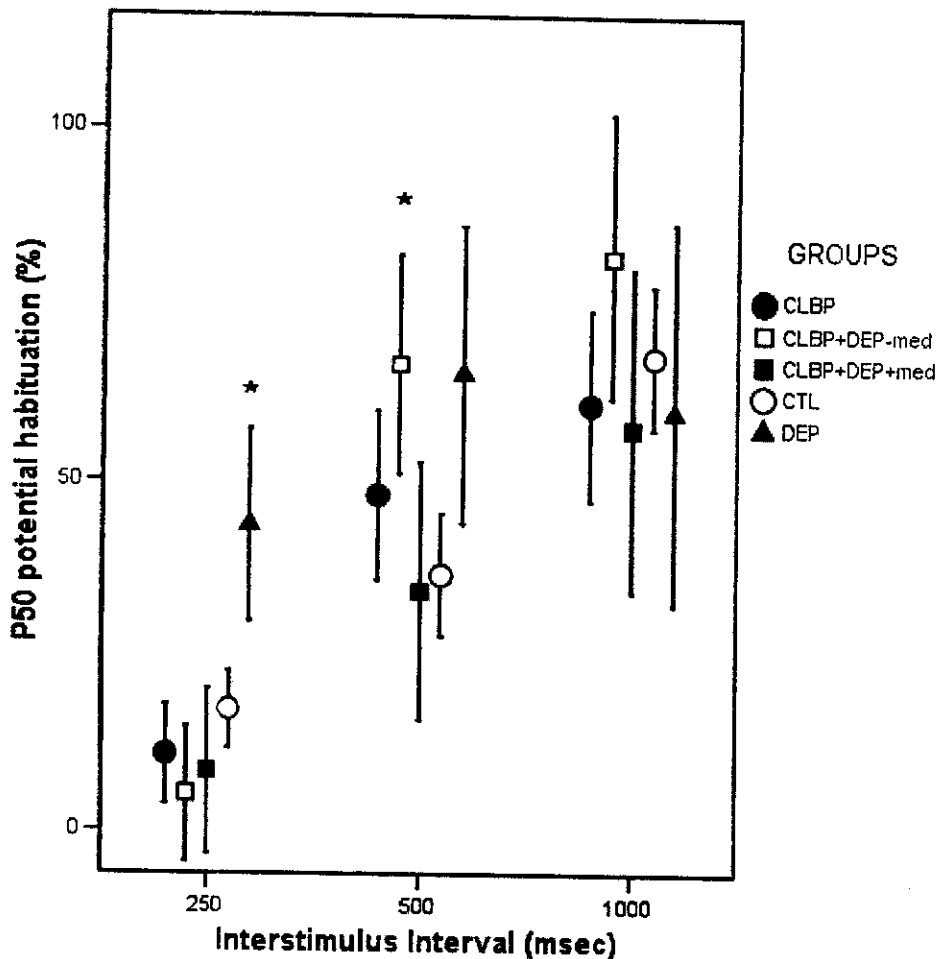
Effect	group	ISI	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
ISI*group	bp	250	10.8123	3.5857	80	3.02	0.0034	0.05	3.6765	17.9481
ISI*group	bp+d+m	250	8.4862	5.9462	80	1.43	0.1574	0.05	-3.3472	20.3197
ISI*group	bp+d-m	250	5.2467	4.8551	80	1.08	0.2831	0.05	-4.4153	14.9086
ISI*group	ctl	250	17.2784	2.7649	80	6.25	<.0001	0.05	11.7760	22.7808
ISI*group	dep	250	43.6667	6.8661	80	6.36	<.0001	0.05	30.0026	57.3307
ISI*group	bp	500	47.8849	6.0019	80	7.98	<.0001	0.05	35.9408	59.8290
ISI*group	bp+d+m	500	34.2400	9.2507	80	3.70	0.0004	0.05	15.8306	52.6494
ISI*group	bp+d-m	500	66.6021	7.8522	80	8.48	<.0001	0.05	50.9757	82.2284
ISI*group	ctl	500	36.5600	4.3874	80	8.33	<.0001	0.05	27.8288	45.2912
ISI*group	dep	500	65.1667	10.6817	80	6.10	<.0001	0.05	43.9093	86.4240
ISI*group	bp	1000	60.7794	6.8820	80	8.83	<.0001	0.05	47.0838	74.4749
ISI*group	bp+d+m	1000	57.3165	11.5842	80	4.95	<.0001	0.05	34.2633	80.3698
ISI*group	bp+d-m	1000	81.9562	10.1365	80	8.09	<.0001	0.05	61.7839	102.13
ISI*group	ctl	1000	67.6246	5.1669	80	13.09	<.0001	0.05	57.3420	77.9071
ISI*group	dep	1000	59.6394	13.6390	80	4.37	<.0001	0.05	32.4970	86.7818

with CS $F = 3.75$, using UN structure is more powerful for this data.

The Mixed Procedure

Tests of Effect Slices

Effect	ISI	Num DF	Den DF	F Value	Pr > F
ISI*group	250	4	80	6.18	0.0002
ISI*group	500	4	80	4.10	0.0045
ISI*group	1000	4	80	0.98	0.4218



I made this graph.

only took about

3 hrs

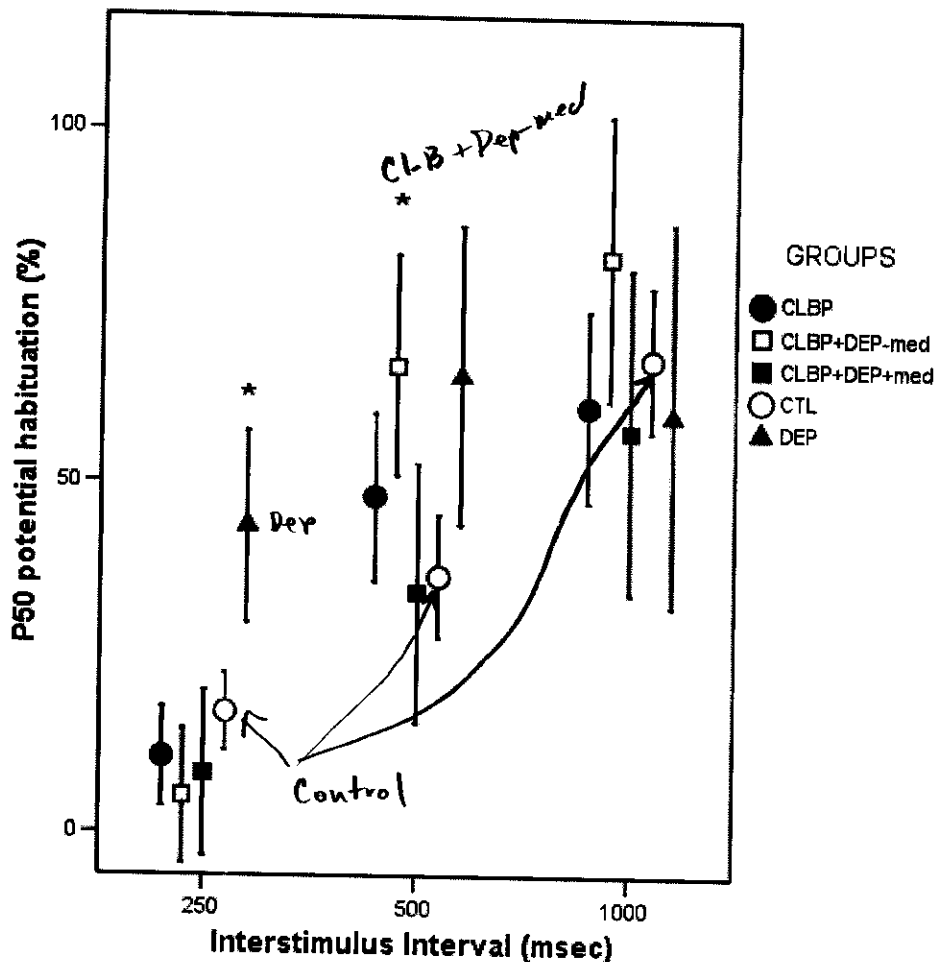
```
libname edgar 'e:/garcia rill';
proc mixed data=edgar.aep_hep ;
class subject isi group;
model hab__=group|isi ;
repeated/subject=subject type=cs r rcorr;
lsmeans group*isi/ slice=isi cl;
run;quit;
proc mixed data=edgar.aep_hep ;
class subject isi group;
model hab__=group|isi ;
repeated/subject=subject type=un r rcorr;
lsmeans group*isi/ slice=isi cl;
run;quit;
```

SAS code for output, Not Graph.

The Mixed Procedure

Tests of Effect Slices

Effect	ISI	Num DF	Den DF	F Value	Pr > F
ISI*group	250	4	80	6.18	0.0002
ISI*group	500	4	80	4.10	0.0045
ISI*group	1000	4	80	0.98	0.4218



```

libname edgar 'e:/garcia rill';
proc mixed data=edgar.aep_hep ;
class subject isi group;
model hab__=group|isi ;
repeated/subject=subject type=cs r rcorr;
lsmeans group*isi/ slice=isi cl;
run;quit;
proc mixed data=edgar.aep_hep ;
class subject isi group;
model hab__=group|isi ;
repeated/subject=subject type=un r rcorr;
lsmeans group*isi/ slice=isi cl;
run;quit;

```

```
libname edgar 'C:\old drive 2\garcia rill\aedp_hep project Aug 2004';
```

```
proc mixed data=edgar.aep_hep ;
class subject isi group;
where isi=250;
model hab_ =group|isi ;
repeated/subject=subject type=un r rcorr;
lsmeans group/ cl pdiff=control('ctl') adjust=dunnett;
run;quit;
```

↳ contrasts
Control versus others.

Least Squares Means isi 250

Effect	group	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
group	bp	10.8123	3.5857	80	3.02	0.0034	0.05	3.6764	17.9481
group	bp+d+m	8.4862	5.9463	80	1.43	0.1574	0.05	-3.3472	20.3197
group	bp+d-m	5.2467	4.8551	80	1.08	0.2831	0.05	-4.4153	14.9087
group	ctl	17.2784	2.7650	80	6.25	<.0001	0.05	11.7759	22.7808
group	dep	43.6667	6.8662	80	6.36	<.0001	0.05	30.0026	57.3308

Differences of Least Squares Means

Effect	group	group	Estimate	Standard Error	DF	t Value	Pr > t	Adjustment	Adj P
group	bp	ctl	-6.4661	4.5280	80	-1.43	0.1572	Dunnett	0.4742
group	bp+d+m	ctl	-8.7921	6.5577	80	-1.34	0.1838	Dunnett	0.5340
group	bp+d-m	ctl	-12.0317	5.5872	80	-2.15	0.0343	Dunnett	0.1247
group	dep	ctl	26.3883	7.4020	80	3.57	0.0006	Dunnett	<u>0.0024</u>



Differences of Least Squares Means

Effect	group	group	Alpha	Lower	Upper	Adj Lower	Adj Upper
group	bp	ctl	0.05	-15.4771	2.5449	-17.9468	5.0146
group	bp+d+m	ctl	0.05	-21.8423	4.2581	-25.4191	7.8349
group	bp+d-m	ctl	0.05	-23.1507	-0.9128	-26.1981	2.1347
group	dep	ctl	0.05	11.6579	41.1187	<u>7.6206</u>	<u>45.1560</u>



```
proc mixed data=edgar.aep_hep ;
class subject isi group;
where isi=500;
model hab__=group|isi ;
repeated/subject=subject type=un r rcorr;
lsmeans group/ cl pdiff=control('ctl') adjust=dunnett;
run;quit;
```

4 contrasts
All versus control

Least Squares Means isi 500

Effect	group	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
group	bp	49.1517	6.2083	73	7.92	<.0001	0.05	36.7786	61.5248
group	bp+d+m	34.2400	9.3124	73	3.68	0.0004	0.05	15.6803	52.7997
group	bp+d-m	66.8500	7.9417	73	8.42	<.0001	0.05	51.0223	82.6777
group	ctl	36.6743	4.4522	73	8.24	<.0001	0.05	27.8011	45.5475
group	dep	65.1667	10.7531	73	6.06	<.0001	0.05	43.7358	86.5975

Differences of Least Squares Means

Effect	group	group	Estimate	Standard Error	DF	t Value	Pr > t	Adjustment	Adj P
group	bp	ctl	12.4774	7.6397	73	1.63	0.1067	Dunnett	0.3464
group	bp+d+m	ctl	-2.4343	10.3220	73	-0.24	0.8142	Dunnett	0.9986
group	bp+d-m	ctl	30.1757	9.1045	73	3.31	0.0014	Dunnett	0.0056
group	dep	ctl	28.4924	11.6383	73	2.45	0.0168	Dunnett	0.0631

Differences of Least Squares Means

Effect	group	group	Alpha	Lower	Upper	Adj Lower	Adj Upper
group	bp	ctl	0.05	-2.7485	27.7033	-6.9363	31.8910
group	bp+d+m	ctl	0.05	-23.0060	18.1374	-28.6641	23.7955
group	bp+d-m	ctl	0.05	12.0304	48.3210	7.0397	53.3117
group	dep	ctl	0.05	5.2972	51.6875	-1.0824	58.0672

```

proc mixed data=edgar.aep_hep ;
class subject isi group;
where isi=1000;
model hab__=group|isi ;
repeated/subject=subject type=un r rcorr;
lsmeans group/ cl pdiff=control('ctl') adjust=dunnett;
run;quit;

```

Least Squares Means isi 1000

Effect	group	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
group	bp	60.5430	6.9548	72	8.71	<.0001	0.05	46.6789	74.4071
group	bp+d+m	54.3829	11.7558	72	4.63	<.0001	0.05	30.9482	77.8175
group	bp+d-m	83.8167	10.3676	72	8.08	<.0001	0.05	63.1492	104.48
group	ctl	68.1944	5.1838	72	13.16	<.0001	0.05	57.8607	78.5282
group	dep	60.6000	13.9096	72	4.36	<.0001	0.05	32.8717	88.3283

Differences of Least Squares Means

Effect	group	group	Estimate	Standard Error	DF	t Value	Pr > t	Adjustment	Adj P
group	bp	ctl	-7.6514	8.6742	72	-0.88	0.3807	Dunnett	0.8395
group	bp+d+m	ctl	-13.8116	12.8479	72	-1.08	0.2860	Dunnett	0.7221
group	bp+d-m	ctl	15.6222	11.5913	72	1.35	0.1820	Dunnett	0.5329
group	dep	ctl	-7.5944	14.8442	72	-0.51	0.6105	Dunnett	0.9740

No differences

Differences of Least Squares Means

Effect	group	group	Alpha	Lower	Upper	Adj Lower	Adj Upper
group	bp	ctl	0.05	-24.9431	9.6402	-29.7159	14.4130
group	bp+d+m	ctl	0.05	-39.4235	11.8003	-46.4929	18.8697
group	bp+d-m	ctl	0.05	-7.4847	38.7291	-13.8626	45.1071
group	dep	ctl	0.05	-37.1857	21.9968	-45.3535	30.1646