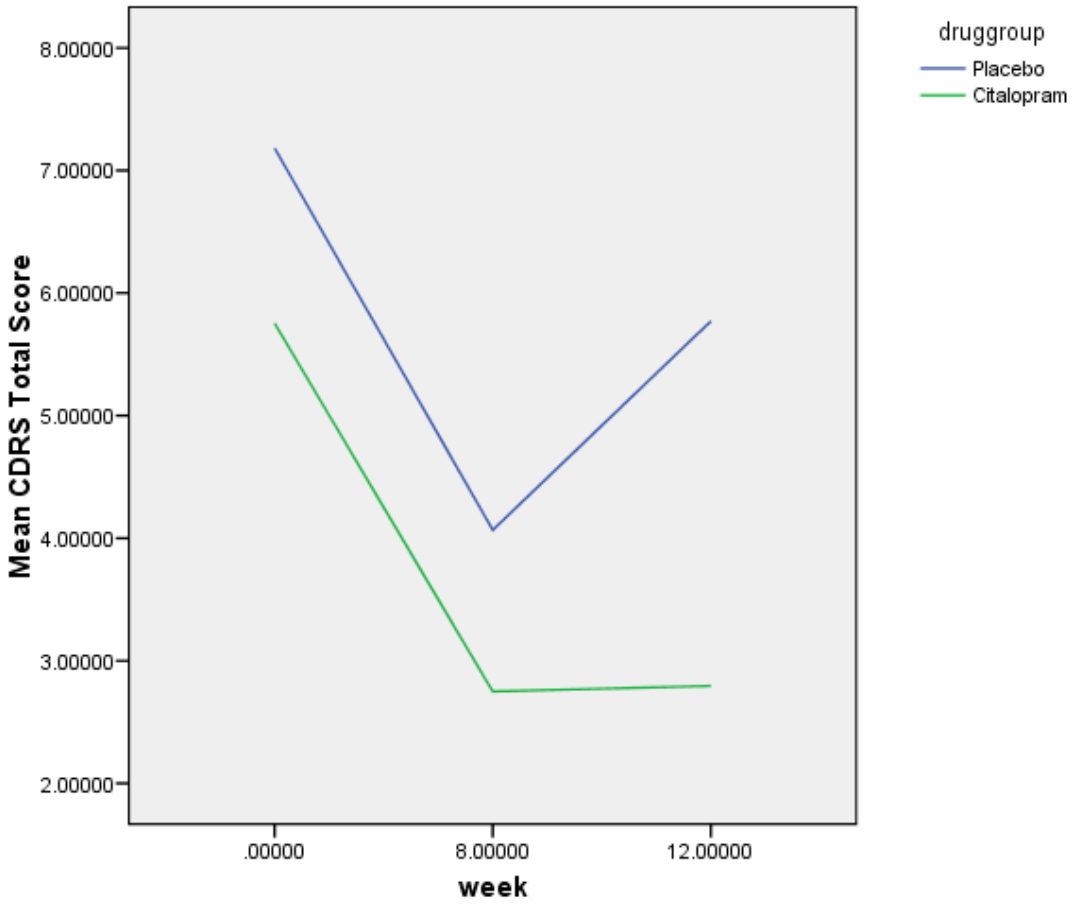
Constructing a mixed model using the AIC

The Data:

- The Citalopram study (PI Dr. Zisook)
  - Does Citalopram reduce the depression in schizophrenic patients with subsyndromal depression
  - Two Groups: Citalopram vs. Placebo
  - 3 time points: baseline, week 0, 8, and 12
  - Outcome measures: CDRS -depression
  - There were two sites, but we will only look at the Cincinnati site.

Step 1:

Look at the means of the outcome variable by time and group



This doesn't appear to be linear, and we have few time points (3). We will treat time as a factor. Meaning that we will assume no particular structure of patients' treatment response over time.

Step 2:
We want to pick a covariance matrix among all likely candidates.

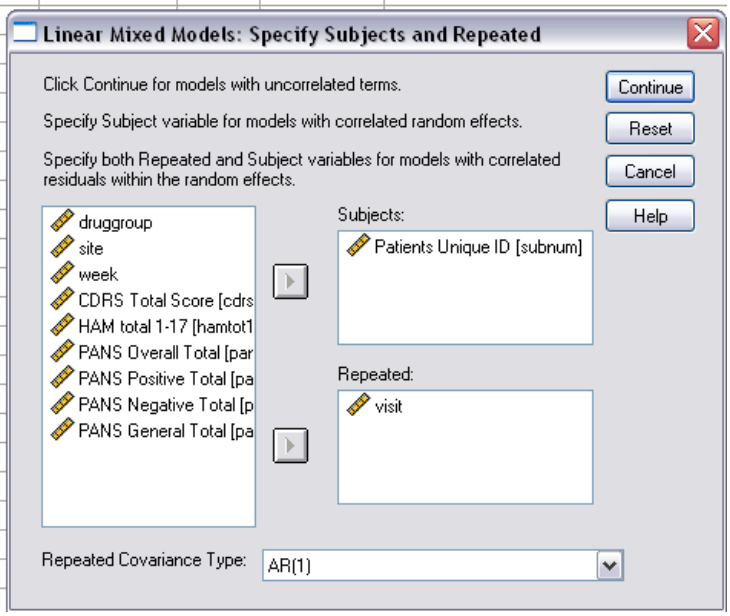
Possibilities are:
CS, AR(1),ARH(1) ANTE(1), TOEP, TOEPH, UNR
Each of these has it's own benefits and assumptions. A quick summary of these is below:

Assumptions:
1.Each time point affects only the time point directly following it.
2.The correlation between consecutive time points is the same for all time points. (Expect this to be violated when the spacing between time points is unequal)
3.Equal variances across time (Expect this to be violated when there is a ceiling effect)

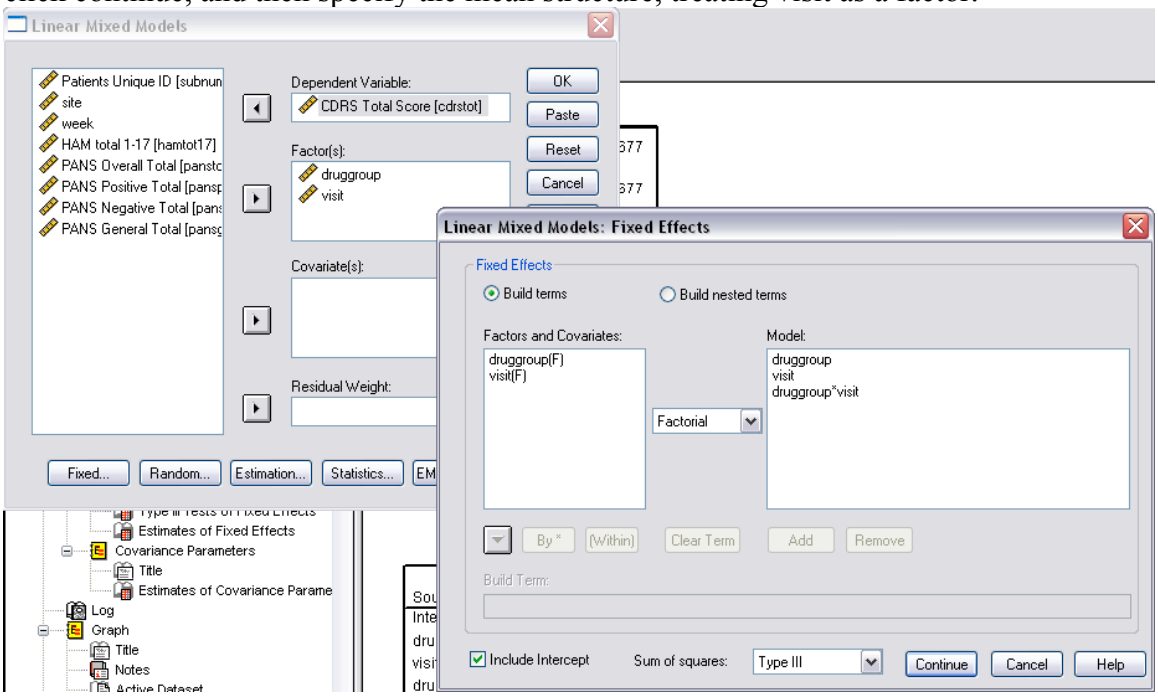
	Homogenious version		Heterogenious version	
	Assumptions	# parameters	Assumptions	# parameters
Compound Symetry: CS "random intercept"	Use only for clustered data. Not for longitudinal!!!!			
Auto regressive: AR(1)				
ARH(1)	1,2,3		2 1,2	# time points
Ante Dependence: ANTE(1)	NA	NA		1 2 * # time points - 1
Toeplitz: TOEP TOEPH	2,3	# time points		2 2 * # time points - 1
Unstructured: UN UNR	NA	NA	no assumptions	#time points * (# time points +1)/2

Create mixed model with the simplest covariance matrix AR(1):

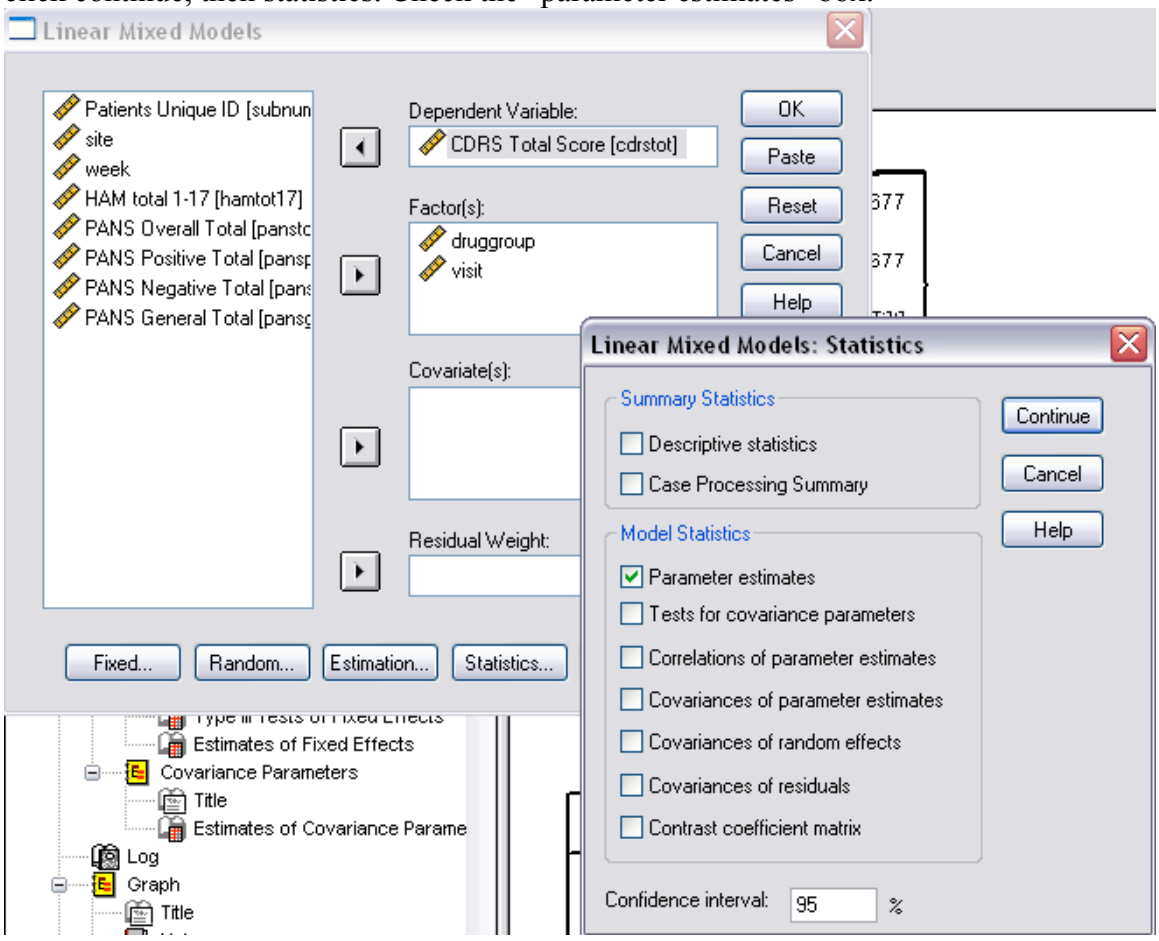
	Name	Type	Width	Decimals	Label
1	subnum	Numeric	8	0	Patients Unique ID
2	druggroup	Numeric	20	5	
3	site	Numeric	20	5	
4	visit	Numeric	20	5	
5	week	Numeric	20	5	
6	cdrstot	Numeric	20	5	CDRS Total Score
7	hamtot17	Numeric	20	5	HAM total 1-17
8	panstot	Numeric	20	5	PANS Overall Total
9	panspos	Numeric	20	5	PANS Positive Total
10	pansneg	Numeric	20	5	PANS Negative Total
11	pansgen	Numeric	20	5	PANS General Total



click continue, and then specify the mean structure, treating visit as a factor.



click continue, then statistics. Check the “parameter estimates” box.



Click continue, and OK.

Step 3:
Write down Akaike’s information criterion (AIC)

The second item outputted by SPSS is a series of information criterion.

Information Criteria(a)

-2 Restricted Log Likelihood	1270.398
Akaike's Information Criterion (AIC)	1274.398
Hurvich and Tsai's Criterion (AICC)	1274.448
Bozdogan's Criterion (CAIC)	1283.359

Schwarz's Bayesian Criterion (BIC)	1281.359

The information criteria are displayed in smaller-is-better forms.
a Dependent Variable: CDRS Total Score.

So the AIC for the AR(1) structure is 1274.398

Step 4:
Repeat steps 2 and 3 for each of our candidates.

ARH(1)

Information Criteria(a)

-2 Restricted Log Likelihood	1270.265
Akaike's Information Criterion (AIC)	1278.265
Hurvich and Tsai's Criterion (AICC)	1278.436
Bozdogan's Criterion (CAIC)	1296.188
Schwarz's Bayesian Criterion (BIC)	1292.188

The information criteria are displayed in smaller-is-better forms.
a Dependent Variable: CDRS Total Score.

ANTE(1)

Information Criteria(a)

-2 Restricted Log Likelihood	1269.359
Akaike's Information Criterion (AIC)	1279.359
Hurvich and Tsai's Criterion (AICC)	1279.615
Bozdogan's Criterion (CAIC)	1301.762
Schwarz's Bayesian Criterion (BIC)	1296.762

The information criteria are displayed in smaller-is-better forms.
a Dependent Variable: CDRS Total Score.

TOEP

Information Criteria(a)

-2 Restricted Log Likelihood	1265.766
Akaike's Information Criterion (AIC)	1271.766
Hurvich and Tsai's Criterion (AICC)	1271.868
Bozdogan's Criterion (CAIC)	1285.208
Schwarz's Bayesian Criterion (BIC)	1282.208

The information criteria are displayed in smaller-is-better forms.
a Dependent Variable: CDRS Total Score.

TOEPH

Information Criteria(a)

-2 Restricted Log Likelihood	1265.578
Akaike's Information Criterion (AIC)	1275.578
Hurvich and Tsai's Criterion (AICC)	1275.834
Bozdogan's Criterion (CAIC)	1297.981
Schwarz's Bayesian Criterion (BIC)	1292.981

The information criteria are displayed in smaller-is-better forms.
a Dependent Variable: CDRS Total Score.

UNR

Information Criteria(a)

-2 Restricted Log Likelihood	1264.412
Akaike's Information Criterion (AIC)	1276.412
Hurvich and Tsai's Criterion (AICC)	1276.772

Bozdogan's Criterion (CAIC)	1303.296
Schwarz's Bayesian Criterion (BIC)	1297.296

The information criteria are displayed in smaller-is-better forms.
a Dependent Variable: CDRS Total Score.

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so TOEP (toeplitz) has the best AIC (1271.766), so we should use this structure for our final analysis.

Step 5:
Interpret the fixed effects of the best model.

Type III Tests of Fixed Effects(a)

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	95.185	274.859	.000
druggroup	1	95.185	11.992	.001
visit	2	138.776	27.461	.000
druggroup * visit	2	138.776	1.996	.140

a Dependent Variable: CDRS Total Score.

There is no significant druggroup*visit interaction, so we can not conclude that there is an difference between the two groups across time.

Estimates of Fixed Effects(b)

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	2.779949	.539078	209.454	5.157	.000	1.717236	3.842662
[druggroup=1.00000]	2.987248	.783946	208.977	3.811	.000	1.441791	4.532704
[druggroup=2.00000]	0(a)	0	.	.	.	.	.
[visit=1.00000]	2.974768	.586244	94.464	5.074	.000	1.810841	4.138694
[visit=7.00000]	-.071706	.595752	115.491	-.120	.904	-1.251722	1.108310
[visit=8.00000]	0(a)	0	.	.	.	.	.
[visit=1.00000] * [druggroup=1.00000]	-1.558291	.851504	94.940	-1.830	.070	-3.248754	.132171
[visit=7.00000] * [druggroup=1.00000]	-1.466493	.890916	114.622	-1.646	.102	-3.231288	.298302
[visit=8.00000] * [druggroup=1.00000]	0(a)	0	.	.	.	.	.

[visit=1.00000] * [druggroup=2.00000]	0(a)	0	.	.	.	.	.
[visit=7.00000] * [druggroup=2.00000]	0(a)	0	.	.	.	.	.
[visit=8.00000] * [druggroup=2.00000]	0(a)	0	.	.	.	.	.

a This parameter is set to zero because it is redundant.
b Dependent Variable: CDRS Total Score.

Looking at the parameter estimates we see that there is a significant druggroup effect, and because our reference time point is the last visit, this means that the two groups are significantly different at the study endpoint.