Assumption Testing/ Saturated Models

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Prior to estimating heritability

- Need to examine the data check for homogeneity of
  - means, variance/standard deviation, covariance/correlation
  - Between co-twins, across zygosity groups
- Determine what covariates should be applied
- Sometimes referred to as a saturated model (esp in NL publications)

In its simplest form…

- Data set is subset by zygosity (2, 5 or 6 groups)
- Estimate the means and variances of the two co-twins within each zygosity group
- Estimate the covariation between co-twins for each zyg group
- Within each zyg group 5 parameters estimated
  - 2 Means, 2 Variances, 1 Covariance
- In subsequent models we test for homogeneity of these parameters by setting them to be equal and comparing the fit of the constrained model to that of the previous model

- Great example paper

Twin Research (1999) 2, 250–257

http://www.stockton-press.co.uk/tr

Genetic and environmental causes of variation in basal levels of blood cells

David M Evans[1], Ian H Frazer[2] and Nicholas G Martin[1]

Table 4a Contrasts used to test hypotheses about means (*m*) and variances (*v*) in the analysis of individual observations for twin pairs

	$H0_{m,v}$		$H1_{m,v}$		$H2_{m,v}$		$H3_{m,v}$		$H4_{m,v}$	
Zygosity group	*T1*	*T2*	*T1*	*T2*	*T1*	*T2*	*T1*	*T2*	*T1*	*T2*
1. MZFF	1	2	1	1	1	1	1	1	1	1
2. MZMM	3	4	2	2	2	2	2	2	1	1
3. DZFF	5	6	3	3	1	1	1	1	1	1
4. DZMM	7	8	4	4	2	2	2	2	1	1
5. DZOS	9	10	5	6	3	4	1	2	1	1

Our script

- continuousAsumptionsSD.R
- In each of the 5 zyg groups we will
  - extract a subset of the data
  - estimate 2 means
  - apply an age correction to the means
  - estimate 2 sd & 1 co-twin correlation
  - multiply the correlation by the sd to produce a covariance matrix
  - compile a model which includes data, means model & covariance model

Calculating the covariance matrix

- Remember a correlation is a standardised covariance
  - Covariance = $\sigma_{XY} = E[(X - E[X])(Y - E[Y])]$
  - Correlation = $\rho_{XY} = \frac{E[(X-E[X])(Y-E[Y])]}{\sigma_X \sigma_Y}$
- So you can rescale the correlation matrix by pre- and post-multiplying by a diagonal matrix that contains the standard deviations


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