Twins Research Australia
Sample Size Guide

How many twins do I need in my classic twin study?

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This information sheet is a simple guide to choosing a sample size for your classic twin study.

The sample sizes given for the examples in tables 1 and 2 use α = 0.05 and 80% power to detect a difference in the monozygous (MZ) and dizygous (DZ) correlations. These sample size examples:
- assume you will have equal numbers of MZ and DZ pairs,
- are the minimum sample sizes needed to detect a difference, and
- will need to be increased if you want to adjust your analyses for other variables.

When the DZ correlation is expected to be half the MZ correlation

The suggested sample sizes in table 1 assume that the DZ correlation is half the MZ correlation. However, this is quite a large difference and this assumption may under-estimate the sample size you actually need. If you know the expected correlations of your trait of interest in MZ pairs and you can expect DZ correlation to be about half of MZ correlation, use table 1 to determine your sample size.

Table 1. Example of sample sizes where the numbers of MZs and DZs are equal and where the DZ correlation is half the MZ correlation. Expected correlations are approximate.

Expected correlations	Number of MZ pairs	Number of DZ pairs	Trait examples
MZ = 0.9, DZ = 0.45	20	20	Adult height
MZ = 0.8, DZ = 0.4	38	38	IQ in children
MZ = 0.7, DZ = 0.35	66	66	Mammographic density
MZ = 0.6, DZ = 0.3	110	110	Temperament and personality functions in childhood
MZ = 0.5, DA = 0.25	185	185	Diastolic blood pressure

References for trait examples and correlations in table 1: Adult height (Polderman, et al., 2015, figure 3); IQ (Segal, 1985); Mammographic density (Boyd, et al., 2002, table 2); Temperament and personality functions in childhood (Polderman et al., 2015, figure 3); Diastolic blood pressure (Tishler, et al., 1987).

When the DZ correlation is not expected to be half the MZ correlation

The suggested sample sizes in table 2 have DZ correlations that are not exactly half the MZ correlation.

Table 2. Example of sample sizes where the numbers of MZs and DZs are equal and where the DZ correlation is not half the MZ correlation. Expected correlations are approximate.

Expected correlations	Number of MZ pairs	Number of DZ pairs	Trait examples
MZ = 0.95, DZ = 0.75	25	25	Cleft lip
MZ = 0.8, DZ = 0.6	99	99	Body mass index
MZ = 0.7, DZ = 0.3	54	54	Specific personality disorders in adolescents
MZ = 0.5, DZ = 0.3	277	277	Depressive episode in adolescents
MZ = 0.45, DZ = 0.35	1,107	1,107	Pulse rate
MZ = 0.3, DA = 0.2	1,380	1,380	Sensitivity to caffeine taste

References for trait examples and correlations in table 2: Cleft lip (Polderman, et al., 2015, supp. table 21); BMI (Harrap, et al., 2000, figure 2); Specific personality disorders in adolescents (Polderman, et al., 2015, figure 3); Depressive episode in adolescents (Polderman, et al., 2015, figure 3); Pulse rate (Harrap, et al., 2000, figure 3); Sensitivity to caffeine taste (Hwang, et al., 2016, table 1).

Performing your own calculations

If the estimated DZ and MZ correlations for your trait of interest differ from the examples provided, or if you want to change the α or power values, you can use a package such as Stata to calculate your required sample size.

For example, use the following command in Stata (StataCorp, 2017) to calculate the sample size for a study with α = 0.01 and power = 90% where you expect the MZ correlation to be 0.8 and the DZ correlation to be 0.5:

```
power twocorrelations 0.8 0.5, alpha(0.01) power(0.9)

Performing iteration …

Estimated sample sizes for a two-sample correlations test
Fisher's z test
Ho: r2 = r1 versus Ha: r2 != r1

Study parameters:

        alpha =      0.0100
        power =      0.9000
        delta =     -0.3000
           r1 =      0.8000
           r2 =      0.5000

Estimated sample sizes:

            N =         204
    N per group =       102
```

From these results, you will need 102 MZ pairs and 102 DZ pairs in your study.

If you want to explore different values for α and power, you can include these in the one command. For example, if you want to see the required sample sizes for α = 0.05 and α = 0.01, and for power = 80% and power = 90%, use the following command:

```
power twocorrelations 0.8 0.5, alpha(0.01 0.05) power(0.8 0.9)

Performing iteration …

Estimated sample sizes for a two-sample correlations test
Fisher's z test
Ho: r2 = r1 versus Ha: r2 != r1
```

alpha	power	N	N1	N2	delta	r1	r2
.01	.8	162	81	81	-.3	.8	.5
.01	.9	204	102	102	-.3	.8	.5
.05	.8	112	56	56	-.3	.8	.5
.05	.9	146	73	73	-.3	.8	.5

Stata can also produce some graphs showing the estimated power for given sample sizes. The figure below was produced using the following Stata command:

```
power twocorr (0.2 0.3 0.4) 0.5, n(50(50)600) graph(yline(0.8, lw(1)
lc(black)) recast(line))
```
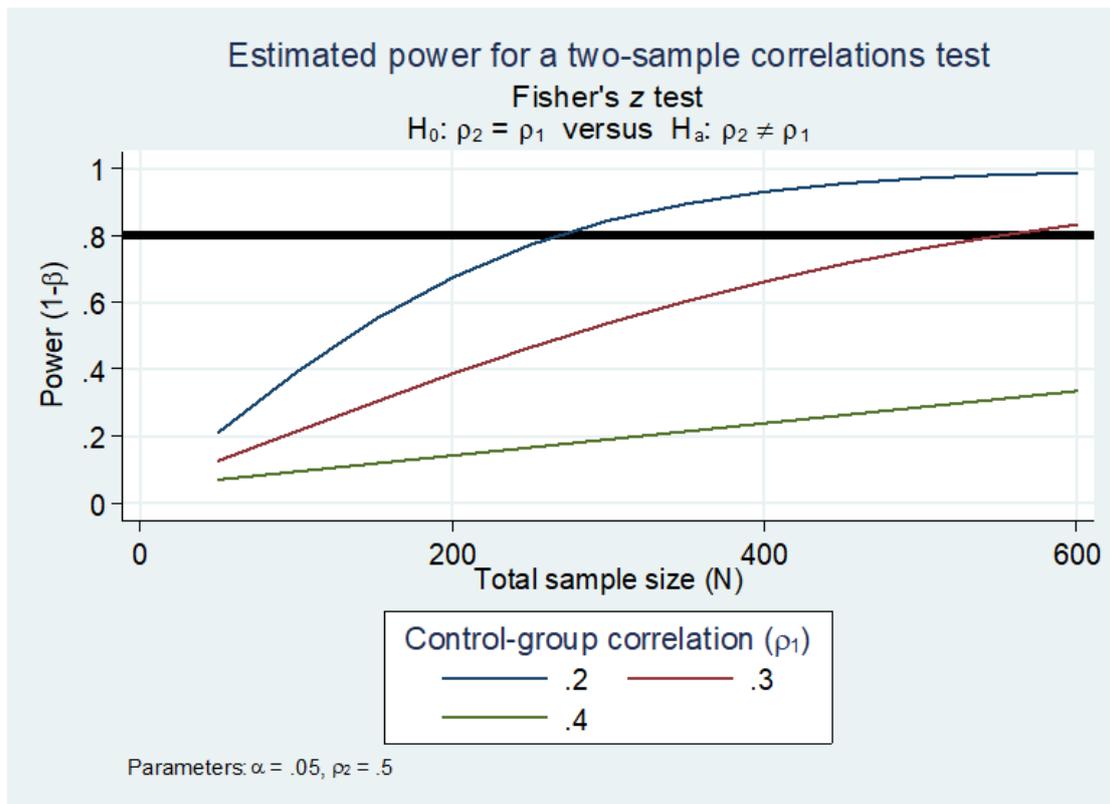

Figure 1. Estimated power for a two-sample correlation test with MZ correlation=0.5.

Figure 1 shows that, for α = 0.05 and power = 80%, and assuming the MZ correlation is 0.5:
- about 550 pairs (total, i.e. 275 MZ pairs and 275 DZ pairs) would be required to detect a significant difference between an MZ correlation of 0.5 and a DZ correlation of 0.3
- about 250 pairs (total, i.e. 125 MZ pairs and 125 DZ pairs) would be required to detect a significant difference between an MZ correlation of 0.5 and a DZ correlation of 0.2.

These calculations depend on some assumptions such as multivariate normality. If these assumptions are not met, these sample size estimates will not be accurate and are more likely to be too low than too high. If in doubt, contact TRA for additional statistical advice.

References

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