Chapter 537

Tests for Two Correlated Proportions with Incomplete Observations

Introduction

This procedure provides power analysis and sample size calculation for studies that use a paired design that yield two binary outcomes that may be incomplete. That is, in some pairs, either the first or the second observation is missing, but not both.

Without incomplete data, the standard analysis is McNemar's Test (see McNemar (1947)), and PASS includes several procedures that analyze this test. This test requires that observations with at least one missing observation must be discarded. Zhang, Cao, and Ahn (2017) present sample size formulas for two extensions of McNemar's Test that use the information provided by pairs that are only partially observed. The first method uses a test that is the result of Thompson (1995), Ekbohm (1982), and Choi and Stablein (1982) the requires the estimation of the two marginal probabilities from the complete and the partial data. The difference of these two estimates is then used for the test.

The second method, proposed by Zhang, Cao, and Ahn (2017), uses the differences between observational pairs directly. This allows this method to be more efficient in most (but not all) situations.

Another method, also available for sample size calculation in PASS, deals with the important case in which all missing values occur in the second observation. We refer to this as *dropout*. We refer to that procedure for further details.

Technical Details

Consider the following table that summarizes the results of a paired design in which one observation of the pair is designated as a treatment and the other is designated as a standard.

	Standard		
Treatment	**Yes**	**No**	**Total**
Yes	P11	P10	Pt
No	P01	P11	1 - Pt
Total	Ps	1 - Ps	1

McNemar's test statistic is the estimated odds ratio

$$Mc = \frac{P10}{P01}$$

Our formulation comes from Zhang, Cao, and Ahn (2017). Denote a binary observation by Y_{ij} where j = t, s gives the group and i = 1, 2, …, N gives the subject. A "success" is represented by $Y_{ij} = 1$ and a "failure" by $Y_{ij} = 0$. Separate the N subjects into three sections so that $N = m_1 + m_2 + m_3$ where m_1 are the subjects that only observed the standard outcome, m_3 are the subjects that only observed the treatment outcome, and m_2 are the subjects that observed both the treatment and standard outcomes.

Let

$\boldsymbol{Y}_1 = \{Y_{is}, i = 1, \ldots, m_1\};$

$\boldsymbol{Y}_2 = \{(Y_{is}, Y_{it}), i = m_1 + 1, \ldots, m_1 + m_2\};$

$\boldsymbol{Y}_3 = \{Y_{it}, i = m_1 + m_2 + 1, \ldots, N\};$

$Pms = m_1/N;$

$Pmt = m_3/N$

Method P

This method is described as follows

1. Construct the estimators of the marginal proportions $\hat{P}_s^{(P)}$ and $\hat{P}_t^{(P)}$ from $\boldsymbol{Y}_2$, the paired data. Use $\hat{P}_s^{(P)} = \sum_{i=m_1+1}^{m_1+m_2} Y_{is}/m_2$ and $\hat{P}_t^{(P)} = \sum_{i=m_1+1}^{m_1+m_2} Y_{it}/m_2$.
2. Construct the estimator of the marginal standard proportion $\hat{P}_s^{(U)}$ from $\boldsymbol{Y}_1$, the unpaired standard data. Use $\hat{P}_s^{(U)} = \sum_{i=1}^{m_1} Y_{is}/m_1$.
3. Construct the estimator of the marginal treatment proportion $\hat{P}_t^{(U)}$ from $\boldsymbol{Y}_3$, the unpaired treatment data. Use $\hat{P}_t^{(U)} = \sum_{i=m_1+m_2+1}^{N} Y_{it}/m_3$.
4. Construct the hybrid estimator using $\hat{P}_s^{(H)} = w_s\hat{P}_s^{(P)} + (1 - w_s)\hat{P}_s^{(U)}$ where $w_s = m_2/(m_1 + m_2)$. This simplifies to $\hat{P}_s^{(H)} = \sum_{i=1}^{m_1+m_2} Y_{is}/(m_1 + m_2)$.
5. Construct the hybrid estimator using $\hat{P}_t^{(H)} = w_t\hat{P}_t^{(P)} + (1 - w_t)\hat{P}_t^{(U)}$ where $w_t = m_2/(m_2 + m_3)$. This simplifies to $\hat{P}_t^{(H)} = \sum_{i=m_1+m_2+1}^{N} Y_{it}/(m_2 + m_3)$.
6. Construct the difference $\hat{\Delta}_P = \hat{P}_t^{(H)} - \hat{P}_s^{(H)}$. Note that $\sqrt{N}(\hat{\Delta}_P - \Delta)$ is approximately normal with mean 0 and variance $\sigma_P^2 = \frac{P_s(1-P_s)}{1-P_{mt}} + \frac{P_t(1-P_t)}{1-P_{ms}} - \frac{2(1-P_{ms}-P_{mt})(P11-P_sP_t)}{(1-P_{ms})(1-P_{mt})}$. It can be estimated using the hybrid estimators found in steps 4 and 5.

Zhang, Cao, and Ahn (2017) provide a formula for the overall sample size for a two-sided test as follows

$$N_P = \frac{\sigma_P^2 \left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2}{\Delta^2}$$

where and α is the probability of a type-I error and β is the probability of a type-II error.

Estimating P11

Obtaining an estimate of $P11$ is often problematic. This problem is solved by using the within-subject correlation coefficient which may be easier to estimate. The relationship between $P11$ and the correlation is

$$\rho = \frac{P11 - P_s P_t}{\sqrt{P_s P_t (1 - P_s)(1 - P_t)}}$$

Using this relationship, values of ρ can be entered and transformed to the corresponding value of $P11$. The only concern is that values of ρ be used that limit $P11$ to be between 0 and 1.

The lower and upper limits of the correlation are

$$\rho_L = \max\left\{-\sqrt{\frac{P_s P_t}{(1 - P_s)(1 - P_t)}}, -\sqrt{\frac{(1 - P_s)(1 - P_t)}{P_s P_t}}\right\}$$

$$\rho_L = \min\left\{\sqrt{\frac{P_s(1 - P_t)}{P_t(1 - P_s)}}, \sqrt{\frac{P_t(1 - P_s)}{P_s(1 - P_t)}}\right\}$$

Method D

This method is described as follows

1. Construct the paired estimator of the difference $\widehat{\Delta}^{(\mathrm{P})}$ directly from $\boldsymbol{Y}_2$, the paired data. Use $\widehat{\Delta}^{(\mathrm{P})} = \sum_{i=m_1+1}^{m_1+m_2} (Y_{it} - Y_{is})/m_2$.
2. Construct the estimator of the marginal standard proportion $\hat{P}_s^{(U)}$ from $\boldsymbol{Y}_1$, the unpaired standard data. Use $\hat{P}_s^{(U)} = \sum_{i=1}^{m_1} Y_{is}/m_1$.
3. Construct the estimator of the marginal treatment proportion $\hat{P}_t^{(U)}$ from $\boldsymbol{Y}_3$, the unpaired treatment data. Use $\hat{P}_t^{(U)} = \sum_{i=m_1+m_2+1}^{N} Y_{it}/m_3$.
4. Construct the unpaired estimator of the difference $\widehat{\Delta}^{(\mathrm{U})}$ from the results of steps 2 and 3. Use $\widehat{\Delta}^{(\mathrm{U})} = \hat{P}_t^{(U)} - \hat{P}_s^{(U)}$.
5. Construct the hybrid estimator using $\widehat{\Delta}_D = w\,\widehat{\Delta}^{(\mathrm{U})} + (1 - w)\widehat{\Delta}^{(\mathrm{P})}$ where $w = V_U/(V_U + V_P)$, $V_U = \frac{P_s(1-P_s)}{P_{ms}} + \frac{P_t(1-P_t)}{P_{mt}}$, and $V_P = \frac{P01+P10-(P01-P10)^2}{1-P_{ms}-P_{mt}}$.
6. Note that $\sqrt{N}(\widehat{\Delta}_D - \Delta)$ is approximately normal with mean 0 and variance $\sigma_D^2 = V_U V_P/(V_U + V_P)$.

Zhang, Cao, and Ahn (2017) provide a formula for the overall sample size for a two-sided test as follows

$$N_D = \frac{\sigma_D^2 \left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2}{\Delta^2}$$

where and α is the probability of a type-I error and β is the probability of a type-II error.

Estimating P01 and P10

Obtaining estimates of $P01$ and $P10$ is often problematic. This problem is solved by using the within-subject correlation coefficient which may be easier to estimate. The relationship between $P11$ and the correlation is

$$\rho = \frac{P11 - P_s P_t}{\sqrt{P_s P_t (1 - P_s)(1 - P_t)}}$$

Using this relationship, values of ρ can be entered and transformed to the corresponding value of $P11$. Once P11 is known, Ps and Pt can be used to solve for $P10$ and $P01$. The only concern is that values of ρ be used that limit $P11$ to be between 0 and 1. These limits are presented above.

Procedure Options

This section describes the options that are specific to this procedure. These are located on the Design tab. For more information about the options of other tabs, go to the Procedure Window chapter.

Design Tab

The Design tab contains most of the parameters and options that you will be concerned with.

Solve For

Solve For

This option specifies the parameter to be solved for from the other parameters. The parameters that may be selected are *Power, Sample Size,* or *Effect Size*.

Note that the value selected here always appears as the vertical axis on the charts.

The program is set up to calculate power directly. To find appropriate values of the other parameters, a binary search is made using an iterative procedure until an appropriate value is found.

Test

Test Type

Two tests are available.

- **Test P (Based on Estimates of Pt and Ps)**

  This test forms one set of estimates of the two proportions (probabilities) from the complete data pairs and a second set of estimates from the incomplete pairs. A set of hybrid estimates of Pt and Ps is constructed using a weighted average of these two sets of estimates. Finally, the difference, Pt - Ps, of these hybrid estimates is used in the test.

- **Test D (Based on Estimates of Difference)**

  This test forms two estimates of the difference of the two proportions directly without first creating the individual estimates of Pt and Ps. Finally, it forms an estimate of the difference as a weighted average of these two estimates.

  In most situations, this estimate of the difference has a smaller variance than does the Test P difference.

Notes

1. In many cases, but not all, this Test P is less efficient than Test D.

2. Test D requires that Pmt > 0 and Pms > 0.

Alternative Hypothesis

Specify the direction of the alternative hypothesis. The choices are:

- **Two-Sided (H1: Pt - Ps ≠ 0)**
  Refers to a two-sided test in which the alternative hypothesis is of the type H1: Pt - Ps ≠ 0.

- **One-Sided (H1: Pt - Ps < 0)**
  Refers to a lower-tailed, one-sided test in which the alternative hypothesis is of the type H1: Pt - Ps < 0.

- **One-Sided (H1: Pt - Ps > 0)**
  Refers to an upper-tailed, one-sided test in which the alternative hypothesis is of the type H1: Pt - Ps > 0.

For one-sided tests, the direction you select must match the values of Pt and Ps you enter. For example, if you select H1: Pt - Ps < 0, then the value of Pt should be less than the value of Ps.

Power and Alpha

Power

This option specifies one or more values for power. Power is the probability of rejecting a false null hypothesis and is equal to one minus Beta. Beta is the probability of a type-II error, which occurs when a false null hypothesis is not rejected.

Values must be between zero and one. Historically, the value of 0.80 (Beta = 0.20) was used for power. Now, 0.90 (Beta = 0.10) is also commonly used.

A single value may be entered or a range of values such as *0.8 to 0.95 by 0.05* may be entered.

If your only interest is in determining the appropriate sample size for a confidence interval, set power to 0.5.

Alpha

This option specifies one or more values for the probability of a type-I error. A type-I error occurs when a true null hypothesis is rejected.

Values must be between zero and one. Usually, the value of 0.05 is used for two-sided tests and 0.025 for one-sided tests.

You may enter a range of values such as *0.01 0.05 0.10* or *0.01 to 0.10 by 0.01*.

Sample Size

N (Number of Pairs)

Enter one or more values for N, the number of pairs in the study. If you enter a list of values, a separate analysis is done for each value.

Range

N > 1

Examples: *10 20 30 40* or *20 to 200 by 20.*

Effect Size – Marginal Probabilities (Pt, Ps)

Pt Input Type

Indicate what type of values to enter to specify Pt, the group 1 event probability. Regardless of the entry type chosen, the same test statistic is used in the power and sample size calculations. This option is simply given for convenience in specifying the Pt.

The choices are

- **Pt**

  Enter values for Pt directly.

- **Difference (Pt - Ps)**

  Enter values for the difference (Pt - Ps) and values for Ps. The corresponding value of Pt will be computed from these two values.

- **Ratio (Pt / Ps)**

  Enter values for the ratio (Pt / Ps) and values for Ps. The corresponding value of Pt will be computed from these two values.

- **Odds Ratio (Ot / Os)**

  Enter values for the odds ratio (Ot / Os) and values for Ps. The corresponding value of Pt will be computed from these two values.

  Note that Ot = Pt / (1 - Pt) and Os = Ps / (1 - Ps)

Pt (Prob (Yit = 1))

Enter a value for the probability that Yit = 1 under the alternative hypothesis, H1. Yit is the binary response of observation t (i = 1, ..., N). In a Pre-Post design, observation t would represent the Posttest.

Values must be between 0 and 1.

You can enter a single value such as *0.1* or a series of values such as *0.1 0.2 0.3* or *0.1 to 0.5 by 0.1*.

Note

This value must be different from Ps.

Difference (Pt - Ps)

Enter the difference between Pt and Ps. This difference is used with Ps to calculate the value of Pt using the formula: Pt = Diff + Ps.

You can enter a single value such as *0.05* or a series of values such as *0.03 0.05 0.10* or *0.01 to 0.09 by 0.02*.

Range

Differences must be between -1 and 1. They cannot take on the values -1, 0, or 1. The resulting value of Pt must be between 0 and 1. If it is not, the scenario is skipped.

Ratio (Pt / Ps)

Enter the ratio of the two probabilities Pt and Ps. This ratio is used with Ps to calculate the value of Pt using the formula: Pt = Ratio x Ps.

You can enter a single value such as *0.5* or a series of values such as *0.5 0.6 0.7 0.8* or *0.25 to 2.0 by 0.25*.

Range

Ratios must be greater than zero. They cannot take on the value of one. The resulting value of Pt must be between 0 and 1. If it is not, it is changed so that it is between 0 and 1.

Odds Ratio (Ot / Os)

This option specifies the odds ratio between the two probabilities Pt and Ps. This value is used with Ps to calculate the value of Pt.

You can enter a single value such as *0.5* or a series of values such as *0.5 0.6 0.7 0.8* or *1.25 to 2.0 by 0.25*.

Range

Odds ratios must be greater than zero. They cannot take on the value of one.

Ps (Prob (Yis = 1))

Enter a value for the probability that Yis = 1 under the both hypotheses, H0 and H1. Yis is the binary response of observation s, i = 1, ..., N. In a Pre-Post design, observation s would represent the Pretest.

Values must be between 0 and 1.

You can enter a single value such as *0.1* or a series of values such as *0.1 0.2 0.3* or *0.1 to 0.5 by 0.1*.

Note

Ps must be different from Pt.

Effect Size – Joint Probability (P11)

P11 Input Type

Indicate how to specify P11, the joint probability that Yis = 1 and Yit = 1. Since this value is seldom known at the time a study is planned, it is usually easier to specify the within-subject correlation, ρ, and let the program compute P11 from it.

Regardless of the entry type chosen, the same test statistic is used in the power and sample size calculations. This option is simply given for convenience in specifying P11.

The choices are

- **ρ (Within-Subject Correlation)**
  Enter values for ρ, the within-subject correlation.

- **P11 (Prob (Yit = Yis = 1))**
  Enter values for P11 directly. This option will usually be used when power is being calculated after an experiment has been run or a reliable estimate of P11 is available from a previous, or pilot, study.

ρ (Within-Subject Correlation)

Enter one or more values for ρ, the correlation of observations within the same subject (pair).

At least one value must be entered. If multiple values are entered, a separate analysis is performed for each value.

Range

-ρL < ρ < ρU. A value near 0 indicates low correlation. A value near 1 indicates high correlation. The boundaries ρL and ρU are based on the marginal probabilities Pt and Ps. They guarantee that P11 will be within a suitable range.

Examples are a single value such as *0.5* or a list of values such as *0.5 0.6 0.7* or *0 to 0.9 by 0.1*

P11 (Prob (Yit = Yis = 1))

Enter one or more values for P11, the joint probability that Yis = 1 and Yit = 1. This option will usually be used when power is being calculated after an experiment has been run or a reliable estimate of P11 is available from a previous, or pilot, study.

At least one value must be entered. If multiple values are entered, a separate analysis is performed for each value.

Range

$0 < P11 < 1$.

Examples are a single value such as *0.2* or a list of values such as *0.1 0.2 0.3* or *0.1 to 0.9 by 0.1*

Incomplete (Missing) Data

Pmt and Pms Input Type

Specify how you want to enter the values of the probabilities that Yis and Yit are missing.

Two possibilities are available:

- **Pmt = Pms (Enter One Value for Both)**
  Enter a single value that will be used for both Pmt and Pms. That is, when they are to be equal.

- **Pmt ≠ Pms (Enter Two Values)**
  Enter separate values for Pmt and Pms.

P_M = Pmt = Pms (Prob (Yit = Missing))

Enter one or more values for the probability of obtaining a missing value for either Yit or Yis when the other is non-missing.

At least one value must be entered. If multiple values are entered, a separate analysis is performed for each value.

Range

For Test P: $0 \le P_M = Pmt = Pms < 1$.

For Test D: $0 < Pmt, Pms < 1$.

Pmt (Prob (Yit = Missing))

Enter one or more values for the probability of obtaining a missing value for Yit when Yis is non-missing.

At least one value must be entered. If multiple values are entered, a separate analysis is performed for each value.

Range

For Test A: $0 \le Pmt < 1$.

For Test B: $0 < Pmt < 1$.

Pms (Prob (Yic = Missing))

Enter one or more values for the probability of obtaining a missing value for Yic when Yit is non-missing.

At least one value must be entered. If multiple values are entered, a separate analysis is performed for each value.

Range

For Test A: $0 \le Pms < 1$.

For Test B: $0 < Pms < 1$.

Example 1 – Calculating Sample Size

Suppose a dental clinical trial is being planned in which two sites are selected in each subject's mouth. One site is randomly assigned to receive the treatment intervention and the other is assigned the standard intervention. The trial is being conducted to compare two treatments for gingivitis. In the study, suppose Ps = 0.5; Pt = 0.6, 0.65, 0.7; ρ = 0, 0.2, 0.4, 0.6, 0.8; *alpha* = 0.05; and *power* = 0.9. Similar studies have had $Pmt = Pms$ = 0.1. Sample size is to be calculated for a two-sided test. Since both missing value rates are non-zero, it is decided to base sample size estimates on the more efficient test method D.

Setup

This section presents the values of each of the parameters needed to run this example. First, from the PASS Home window, load the procedure window. You may then make the appropriate entries as listed below, or open **Example 1** by going to the **File** menu and choosing **Open Example Template**.

Option	Value
Design Tab	
Solve For	**Sample Size**
Test Type	**Test D (Based on Estimates of Difference)**
Alternative Hypothesis	**Two-Sided (Pt ≠ Ps)**
Power	**0.9**
Alpha	**0.05**
Pt Input Type	**Pt**
Pt (Prob (Yit = 1))	**0.6 0.65 0.7**
Ps (Prob (Yis = 1))	**0.5**
P11 Input Type	**ρ (Within-Subject Correlation)**
ρ (Within-Subject Correlation)	**0 0.2 0.4 0.6 0.8**
Pmt and Pms Input Type	**Pmt = Pms (Enter One Value for Both)**
Pm = Pmt = Pms (Prob (Yit = Missing))	**0.1**

Annotated Output

Click the Calculate button to perform the calculations and generate the following output.

Numeric Results

Numeric Results
Test Statistic:Test D (Based on Estimates of Difference)
Alternative Hypothesis:Two-Sided (Pt ≠ Ps)

Power	Total Sample Size N	Pt	Ps	Pt-Ps Diff	Within Subj Corr ρ	Joint Prob Both Obs=1 P11	Prob Trt Miss Pmt	Prob Std Miss Pms	Alpha
0.9005	573	0.6000	0.5000	0.1000	0.0000	0.3000	0.1000	0.1000	0.050
0.9006	469	0.6000	0.5000	0.1000	0.2000	0.3490	0.1000	0.1000	0.050
0.9006	360	0.6000	0.5000	0.1000	0.4000	0.3980	0.1000	0.1000	0.050
0.9009	246	0.6000	0.5000	0.1000	0.6000	0.4470	0.1000	0.1000	0.050
0.9007	126	0.6000	0.5000	0.1000	0.8000	0.4960	0.1000	0.1000	0.050
0.9003	248	0.6500	0.5000	0.1500	0.0000	0.3250	0.1000	0.1000	0.050
0.9003	203	0.6500	0.5000	0.1500	0.2000	0.3727	0.1000	0.1000	0.050
0.9006	156	0.6500	0.5000	0.1500	0.4000	0.4204	0.1000	0.1000	0.050
0.9017	107	0.6500	0.5000	0.1500	0.6000	0.4681	0.1000	0.1000	0.050
0.9019	55	0.6500	0.5000	0.1500	0.8000	0.5158	0.1000	0.1000	0.050
0.9016	135	0.7000	0.5000	0.2000	0.0000	0.3500	0.1000	0.1000	0.050
0.9001	110	0.7000	0.5000	0.2000	0.2000	0.3958	0.1000	0.1000	0.050
0.9017	85	0.7000	0.5000	0.2000	0.4000	0.4417	0.1000	0.1000	0.050
0.9007	58	0.7000	0.5000	0.2000	0.6000	0.4875	0.1000	0.1000	0.050
0.9009	30	0.7000	0.5000	0.2000	0.8000	0.5333	0.1000	0.1000	0.050

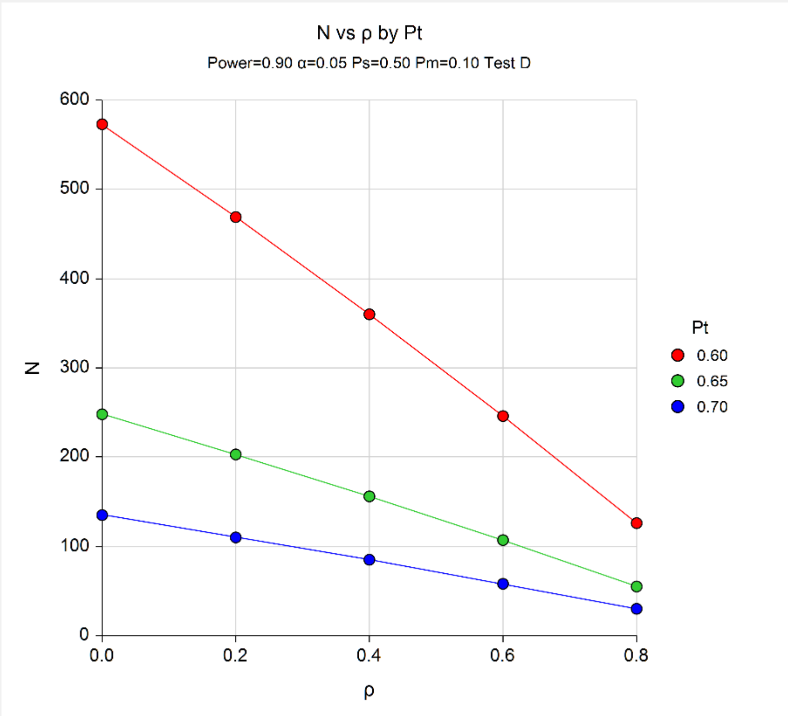
References
Zhang, S., Cao, J., Ahn, C. 2017. 'Inference and sample size calculation for clinical trials with incomplete observations of paired binary outcomes'. Statistics in Medicine. Volume 36. Pages 581-591.

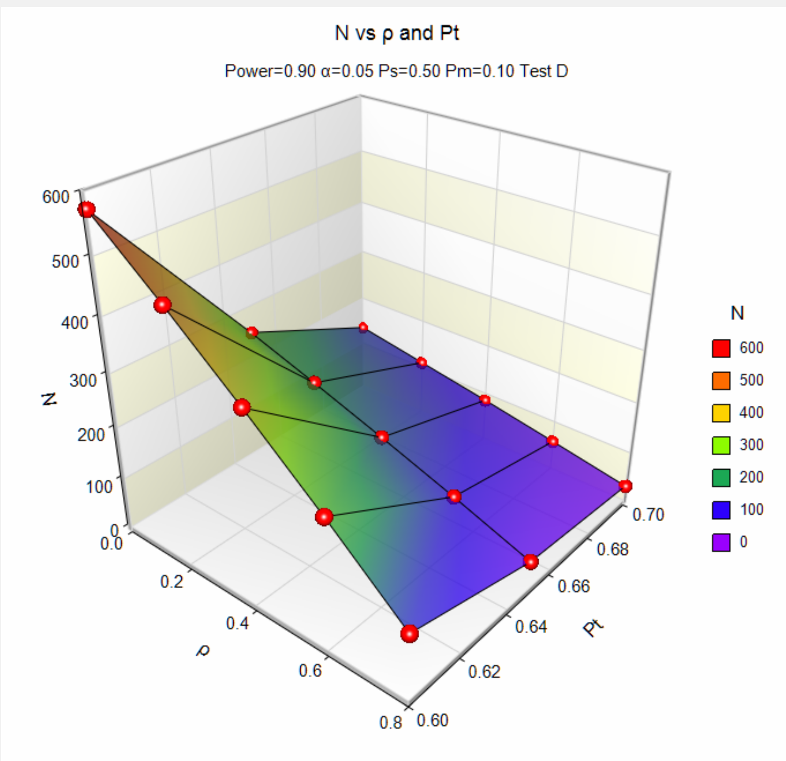
Report Definitions
Power is the probability of rejecting a false null hypothesis.
Total Sample Size N is the total number of subjects in the study.
Pt is the probability of a "true" response in the treatment observation.
Ps is the probability of a "true" response in the standard observation.
Diff (Pt-Ps) is the difference between the two probabilities.
ρ (Within Subj Corr) is the correlation between the two observations within a subject.
P11 (Joint Prob Both Obs=1) is the joint probability that both observations in a pair are true (equal to '1').
Pmt (Prob Trt Miss) is the probability that the treatment observation is missing and the standard observation is observed.
Pms (Prob Std Miss) is the probability that the standard observation is missing and the treatment observation is observed.
Alpha is the significance level of the test: the probability of rejecting the null hypothesis of equal probabilities when it is true.

Summary Statements
When all observation pairs are complete, McNemar's test is usually used. When some observations are missing, a hybrid test statistic is used to test the difference between two response proportions. This hybrid test is a weighted average of the information contained in the complete pairs and the information in the partially-observed pairs. If the hybrid test is formed directly from the paired differences, a sample of 573 subjects achieves 90% power at a significance level of 0.050 to detect a difference of 0.1000. The response proportion of the treatment observation is 0.6000 and of the standard observation is 0.5000. The joint probabilites are calculated from Pt, Ps, and a within-subject correlation of 0.0000. The proportion of missing observations is 0.1000 in the treatment observations and 0.1000 in the control observations.

This report gives the sample size for each of the requested scenarios.

Plots Section





These plots show the sample size for the various combination of the other parameters.

Example 2 – Finding Sample Size and Validation using Zhang, Cao, and Ahn (2017)

Zhang, Cao, and Ahn (2017) page 587 present Table II which provides examples that we can use to validate this procedure. The set of four rows has the following settings: *Ps* = 0.1; *Pt* = 0.15; ρ = 0, 0.1, 0.25, 0.5; *alpha* = 0.05; *power* = 0.8; and Pmt = Pms = 0.1. Sample size is calculated for a two-sided test. The test method is D. The resulting sample sizes are 759, 692, 588, and 408.

Setup

This section presents the values of each of the parameters needed to run this example. First, from the PASS Home window, load the procedure window. You may then make the appropriate entries as listed below, or open **Example 2** by going to the **File** menu and choosing **Open Example Template**.

Option	Value
Design Tab	
Solve For	**Sample Size**
Test Type	**Test D (Based on Estimates of Difference)**
Alternative Hypothesis	**Two-Sided (Pt ≠ Ps)**
Power	**0.8**
Alpha	**0.05**
Pt Input Type	**Pt**
Pt (Prob (Yit = 1))	**0.15**
Ps (Prob (Yis = 1))	**0.1**
P11 Input Type	**ρ (Within-Subject Correlation)**
ρ (Within-Subject Correlation)	**0 0.1 0.25 0.5**
Pmt and Pms Input Type	**Pmt = Pms (Enter One Value for Both)**
Pm = Pmt = Pms (Prob (Yit = Missing))	**0.1**

Output

Click the Calculate button to perform the calculations and generate the following output.

Numeric Results
Test Statistic:Test D (Based on Estimates of Difference)
Alternative Hypothesis:Two-Sided (Pt ≠ Ps)

Power	Total Sample Size N	Pt	Ps	Pt-Ps Diff	Within Subj Corr ρ	Joint Prob Both Obs=1 P11	Prob Trt Miss Pmt	Prob Std Miss Pms	Alpha
0.8001	759	0.1500	0.1000	0.0500	0.0000	0.0150	0.1000	0.1000	0.050
0.8003	692	0.1500	0.1000	0.0500	0.1000	0.0257	0.1000	0.1000	0.050
0.8000	588	0.1500	0.1000	0.0500	0.2500	0.0418	0.1000	0.1000	0.050
0.8006	408	0.1500	0.1000	0.0500	0.5000	0.0686	0.1000	0.1000	0.050

PASS matches the sample sizes of 759, 692, 588, and 408. The procedure is validated.