

## Host

### Notes

|                |                |                                                                                                                                                                                                                       |
|----------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Created |                | 12-JUL-2026 21:34:33                                                                                                                                                                                                  |
| Comments       |                |                                                                                                                                                                                                                       |
| Input          | Data           | D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav\Boschloos-Test-data.sav                                                                                                        |
|                | Filter         | <none>                                                                                                                                                                                                                |
|                | Weight         | <none>                                                                                                                                                                                                                |
|                | Split File     | <none>                                                                                                                                                                                                                |
| Syntax         |                | HOST COMMAND=['cmd /c if not exist "D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output" mkdir "D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output"']. |
| Resources      | Processor Time | 00:00:00.02                                                                                                                                                                                                           |
|                | Elapsed Time   | 00:00:00.15                                                                                                                                                                                                           |

## Host

## Notes

|                |                |                                                                                                                                                                                                                               |
|----------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Created |                | 12-JUL-2026 21:34:33                                                                                                                                                                                                          |
| Comments       |                |                                                                                                                                                                                                                               |
| Input          | Data           | D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav\Boschloos-Test-data.sav                                                                                                                |
|                | Filter         | <none>                                                                                                                                                                                                                        |
|                | Weight         | <none>                                                                                                                                                                                                                        |
|                | Split File     | <none>                                                                                                                                                                                                                        |
| Syntax         |                | HOST COMMAND=['cmd /c if not exist "D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav" mkdir "D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav"']. |
| Resources      | Processor Time | 00:00:00.00                                                                                                                                                                                                                   |
|                | Elapsed Time   | 00:00:00.08                                                                                                                                                                                                                   |

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## Notes

|                |                |                                                                                                                                                                                                                                |
|----------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Created |                | 12-JUL-2026 21:34:33                                                                                                                                                                                                           |
| Comments       |                |                                                                                                                                                                                                                                |
| Input          | Data           | D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav\Boschloos-Test-data.sav                                                                                                                 |
|                | Filter         | <none>                                                                                                                                                                                                                         |
|                | Weight         | <none>                                                                                                                                                                                                                         |
|                | Split File     | <none>                                                                                                                                                                                                                         |
| Syntax         |                | HOST COMMAND=['cmd /c if not exist "D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\spv" mkdir "D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\spv"'].] |
| Resources      | Processor Time | 00:00:00.00                                                                                                                                                                                                                    |
|                | Elapsed Time   | 00:00:00.06                                                                                                                                                                                                                    |

## Host

## Notes

|                |                |                                                                                                                                                                                                                               |
|----------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Created |                | 12-JUL-2026 21:34:34                                                                                                                                                                                                          |
| Comments       |                |                                                                                                                                                                                                                               |
| Input          | Data           | D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav\Boschloos-Test-data.sav                                                                                                                |
|                | Filter         | <none>                                                                                                                                                                                                                        |
|                | Weight         | <none>                                                                                                                                                                                                                        |
|                | Split File     | <none>                                                                                                                                                                                                                        |
| Syntax         |                | HOST COMMAND=['cmd /c if not exist "D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\pdf" mkdir "D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\pdf"']. |
| Resources      | Processor Time | 00:00:00.00                                                                                                                                                                                                                   |
|                | Elapsed Time   | 00:00:00.08                                                                                                                                                                                                                   |

## Boschloo's Test

Boschloo's Test  
Import dataset.csv

## Boschloo Variable Preparation

Boschloo Variable Preparation  
Create independent 2 x 2 data

## Boschloo Prepared Data Summary

Boschloo Prepared Data Summary  
Group and binary outcome frequencies

## Frequencies

### Notes

|                        |                                |                                                                                                                 |
|------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Output Created         |                                | 12-JUL-2026 21:34:34                                                                                            |
| Comments               |                                |                                                                                                                 |
| Input                  | Data                           | D:\DATA ANALYSIS\I Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav\Boschloos-Test-data.sav |
|                        | Active Dataset                 | BoschloosTestData                                                                                               |
|                        | Filter                         | <none>                                                                                                          |
|                        | Weight                         | <none>                                                                                                          |
|                        | Split File                     | <none>                                                                                                          |
|                        | N of Rows in Working Data File | 649                                                                                                             |
| Missing Value Handling | Definition of Missing          | User-defined missing values are treated as missing.                                                             |
|                        | Cases Used                     | Statistics are based on all cases with valid data.                                                              |
| Syntax                 |                                | FREQUENCIES<br>VARIABLES=boschloo_group boschloo_outcome<br>/ORDER=ANALYSIS.                                    |
| Resources              | Processor Time                 | 00:00:00.02                                                                                                     |
|                        | Elapsed Time                   | 00:00:00.01                                                                                                     |

### Statistics

|   |         | Independent group: 0 = female, 1 = male | Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 |
|---|---------|-----------------------------------------|-----------------------------------------------------|
| N | Valid   | 649                                     | 649                                                 |
|   | Missing | 0                                       | 0                                                   |

## Frequency Table

Boschloo Prepared Data Summary  
Group and binary outcome frequencies

**Independent group: 0 = female, 1 = male**

|       |        | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|--------|-----------|---------|---------------|--------------------|
| Valid | Female | 383       | 59.0    | 59.0          | 59.0               |
|       | Male   | 266       | 41.0    | 41.0          | 100.0              |
|       | Total  | 649       | 100.0   | 100.0         |                    |

**Binary outcome: 0 = G3 below 10, 1 = G3 at least 10**

|       |                | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|----------------|-----------|---------|---------------|--------------------|
| Valid | G3 below 10    | 100       | 15.4    | 15.4          | 15.4               |
|       | G3 at least 10 | 549       | 84.6    | 84.6          | 100.0              |
|       | Total          | 649       | 100.0   | 100.0         |                    |

### Observed 2 x 2 Contingency Table

Observed 2 x 2 Contingency Table  
Counts, expected counts, residuals and comparison tests

## Crosstabs

### Notes

|                        |                                |                                                                                                                                                                                                          |
|------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Created         |                                | 12-JUL-2026 21:34:34                                                                                                                                                                                     |
| Comments               |                                |                                                                                                                                                                                                          |
| Input                  | Data                           | D:\DATA ANALYSIS\Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav\Boschloos-Test-data.sav                                                                                            |
|                        | Active Dataset                 | BoschloosTestData                                                                                                                                                                                        |
|                        | Filter                         | <none>                                                                                                                                                                                                   |
|                        | Weight                         | <none>                                                                                                                                                                                                   |
|                        | Split File                     | <none>                                                                                                                                                                                                   |
|                        | N of Rows in Working Data File | 649                                                                                                                                                                                                      |
| Missing Value Handling | Definition of Missing          | User-defined missing values are treated as missing.                                                                                                                                                      |
|                        | Cases Used                     | Statistics for each table are based on all the cases with valid data in the specified range(s) for all variables in each table.                                                                          |
| Syntax                 |                                | CROSSTABS<br><br>/TABLES=boschloo_group<br>BY boschloo_outcome<br>/FORMAT=AVALUE<br>TABLES<br>/STATISTICS=CHISQ<br>RISK PHI<br>/CELLS=COUNT ROW<br>COLUMN EXPECTED<br>RESID SRESID<br>/COUNT ROUND CELL. |
| Resources              | Processor Time                 | 00:00:00.02                                                                                                                                                                                              |
|                        | Elapsed Time                   | 00:00:00.01                                                                                                                                                                                              |
|                        | Dimensions Requested           | 2                                                                                                                                                                                                        |
|                        | Cells Available                | 524245                                                                                                                                                                                                   |

Observed 2 x 2 Contingency Table  
Counts, expected counts, residuals and comparison tests

**Case Processing Summary**

|                                                                                               | Valid |         | Cases Missing |         | Total |         |
|-----------------------------------------------------------------------------------------------|-------|---------|---------------|---------|-------|---------|
|                                                                                               | N     | Percent | N             | Percent | N     | Percent |
| Independent group: 0 = female, 1 = male * Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 | 649   | 100.0%  | 0             | 0.0%    | 649   | 100.0%  |

**Independent group: 0 = female, 1 = male \* Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 Crosstabulation**

|                                         |        |                                                              | Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 |                |
|-----------------------------------------|--------|--------------------------------------------------------------|-----------------------------------------------------|----------------|
|                                         |        |                                                              | G3 below 10                                         | G3 at least 10 |
| Independent group: 0 = female, 1 = male | Female | Count                                                        | 50                                                  | 333            |
|                                         |        | Expected Count                                               | 59.0                                                | 324.0          |
|                                         |        | % within Independent group: 0 = female, 1 = male             | 13.1%                                               | 86.9%          |
|                                         |        | % within Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 | 50.0%                                               | 60.7%          |
|                                         |        | Residual                                                     | -9.0                                                | 9.0            |
|                                         |        | Standardized Residual                                        | -1.2                                                | .5             |
|                                         | Male   | Count                                                        | 50                                                  | 216            |
|                                         |        | Expected Count                                               | 41.0                                                | 225.0          |

Observed 2 x 2 Contingency Table  
Counts, expected counts, residuals and comparison tests

**Independent group: 0 = female, 1 = male \* Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 Crosstabulation**

|                                         |        |                                                              | Total  |
|-----------------------------------------|--------|--------------------------------------------------------------|--------|
| Independent group: 0 = female, 1 = male | Female | Count                                                        | 383    |
|                                         |        | Expected Count                                               | 383.0  |
|                                         |        | % within Independent group: 0 = female, 1 = male             | 100.0% |
|                                         |        | % within Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 | 59.0%  |
|                                         |        | Residual                                                     |        |
|                                         |        | Standardized Residual                                        |        |
|                                         | Male   | Count                                                        | 266    |
|                                         |        | Expected Count                                               | 266.0  |

**Independent group: 0 = female, 1 = male \* Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 Crosstabulation**

|       |                                                              | Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 |                |
|-------|--------------------------------------------------------------|-----------------------------------------------------|----------------|
|       |                                                              | G3 below 10                                         | G3 at least 10 |
|       | % within Independent group: 0 = female, 1 = male             | 18.8%                                               | 81.2%          |
|       | % within Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 | 50.0%                                               | 39.3%          |
|       | Residual                                                     | 9.0                                                 | -9.0           |
|       | Standardized Residual                                        | 1.4                                                 | -.6            |
| Total | Count                                                        | 100                                                 | 549            |
|       | Expected Count                                               | 100.0                                               | 549.0          |
|       | % within Independent group: 0 = female, 1 = male             | 15.4%                                               | 84.6%          |
|       | % within Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 | 100.0%                                              | 100.0%         |

Observed 2 x 2 Contingency Table  
Counts, expected counts, residuals and comparison tests

**Independent group: 0 = female, 1 = male \* Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 Crosstabulation**

|       |                                                              |        |
|-------|--------------------------------------------------------------|--------|
|       |                                                              | Total  |
|       | % within Independent group: 0 = female, 1 = male             | 100.0% |
|       | % within Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 | 41.0%  |
|       | Residual                                                     |        |
|       | Standardized Residual                                        |        |
| Total | Count                                                        | 649    |
|       | Expected Count                                               | 649.0  |
|       | % within Independent group: 0 = female, 1 = male             | 100.0% |
|       | % within Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 | 100.0% |

### Chi-Square Tests

|                                    | Value              | df | Asymptotic Significance (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|------------------------------------|--------------------|----|-----------------------------------|----------------------|----------------------|
| Pearson Chi-Square                 | 3.971 <sup>a</sup> | 1  | .046                              |                      |                      |
| Continuity Correction <sup>b</sup> | 3.543              | 1  | .060                              |                      |                      |
| Likelihood Ratio                   | 3.918              | 1  | .048                              |                      |                      |
| Fisher's Exact Test                |                    |    |                                   | .060                 | .030                 |
| Linear-by-Linear Association       | 3.965              | 1  | .046                              |                      |                      |
| N of Valid Cases                   | 649                |    |                                   |                      |                      |

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 40.99.

b. Computed only for a 2x2 table

Observed 2 x 2 Contingency Table  
Counts, expected counts, residuals and comparison tests

**Symmetric Measures**

|                    |            | Value | Approximate Significance |
|--------------------|------------|-------|--------------------------|
| Nominal by Nominal | Phi        | -.078 | .046                     |
|                    | Cramer's V | .078  | .046                     |
| N of Valid Cases   |            | 649   |                          |

**Risk Estimate**

|                                                                                 | Value | 95% Confidence Interval |       |
|---------------------------------------------------------------------------------|-------|-------------------------|-------|
|                                                                                 |       | Lower                   | Upper |
| Odds Ratio for Independent group: 0 = female, 1 = male (Female / Male)          | .649  | .423                    | .995  |
| For cohort Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 = G3 below 10    | .695  | .485                    | .995  |
| For cohort Binary outcome: 0 = G3 below 10, 1 = G3 at least 10 = G3 at least 10 | 1.071 | .999                    | 1.148 |
| N of Valid Cases                                                                | 649   |                         |       |

## Grouped Bar Chart

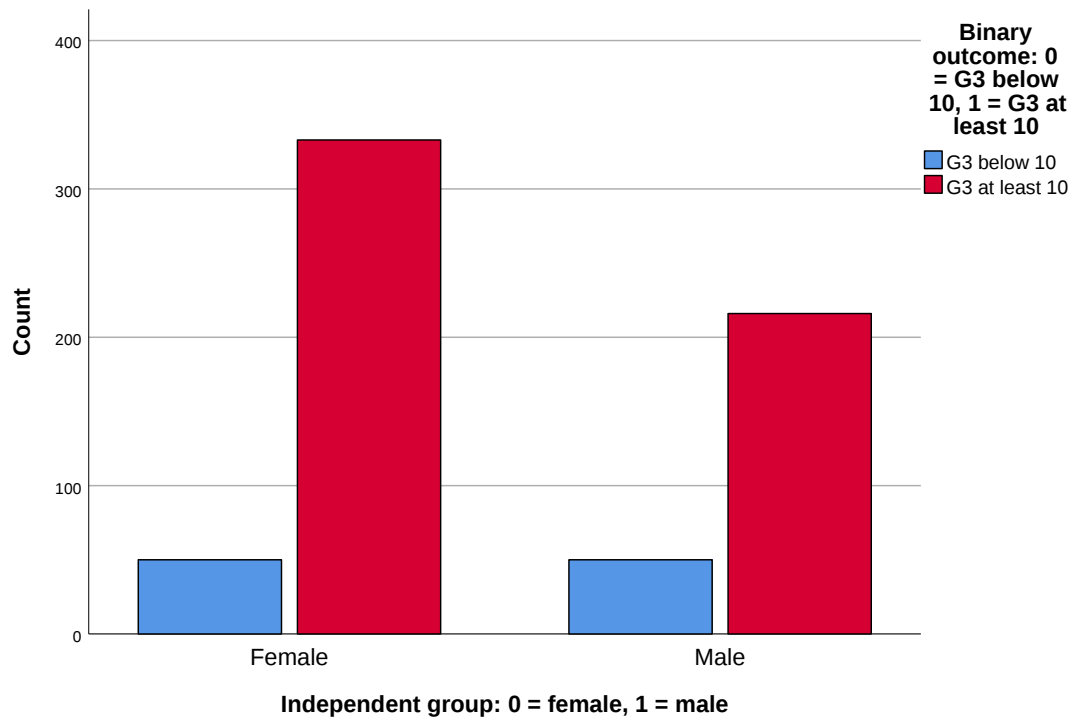
Grouped Bar Chart  
Observed outcome counts by independent group

## Graph

### Notes

|                |                                |                                                                                                                |
|----------------|--------------------------------|----------------------------------------------------------------------------------------------------------------|
| Output Created |                                | 12-JUL-2026 21:34:34                                                                                           |
| Comments       |                                |                                                                                                                |
| Input          | Data                           | D:\DATA ANALYSIS\ Chi Square and Categorical Data Tests\Boschloos Test\SPSS_Output\sav\Boschloos-Test-data.sav |
|                | Active Dataset                 | BoschloosTestData                                                                                              |
|                | Filter                         | <none>                                                                                                         |
|                | Weight                         | <none>                                                                                                         |
|                | Split File                     | <none>                                                                                                         |
|                | N of Rows in Working Data File | 649                                                                                                            |
| Syntax         |                                | GRAPH<br>/BAR(GROUPED)<br>=COUNT BY<br>boschloo_group BY<br>boschloo_outcome.                                  |
| Resources      | Processor Time                 | 00:00:00.61                                                                                                    |
|                | Elapsed Time                   | 00:00:00.37                                                                                                    |

Grouped Bar Chart  
Observed outcome counts by independent group



## True Boschloo Unconditional Exact Test

True Boschloo Unconditional Exact Test  
Pure Python calculation without NumPy or SciPy

```
=====
=====
BOSCHLOO'S UNCONDITIONAL EXACT TEST RESULTS
=====
=====
Rows used: 649
Observed table: Female [333 positive, 50 negative]; Male [216 positive, 50 neg
ative]
-----
-----
Primary test: Boschloo unconditional exact test, two-sided
Selected one-sided direction: greater
Boschloo statistic (selected one-sided Fisher p-value): 0.0304927910
Boschloo exact p-value: 0.0513872452
Decision at alpha = 0.05: Fail to reject H0
Boschloo less p-value: 0.9779287416; maximizing nuisance p: 0.4543795383
Boschloo greater p-value: 0.0256936226; maximizing nuisance p: 0.5905217578
Two-sided convention: twice the smaller one-sided Boschloo p-value, clipped at
1.
-----
-----
Female positive-outcome proportion: 0.869452
Male positive-outcome proportion: 0.812030
Risk difference (Male - Female): -0.057422
Risk ratio (Male / Female): 0.933957
Odds ratio (Male / Female): 0.648649
Cramer's V: 0.078222
Minimum expected count: 40.986133
Haldane-Anscombe correction used for ratios: False
-----
-----
Fisher exact p-value (comparison only): 0.0597970830
Barnard exact p-value (comparison only): 0.0487033356; maximizing nuisance p:
0.9394378496
Pearson chi-square: 3.97103463; df = 1; p = 0.0462893224
Yates corrected chi-square: 3.54270596; df = 1; p = 0.0598078157
-----
-----
```

True Boschloo Unconditional Exact Test  
Pure Python calculation without NumPy or SciPy

Interpretation: Boschloo's test is unconditional and uses a one-sided Fisher p-value as its ordering statistic.

The calculation above uses only the Python standard library supplied with SPSS; NumPy and SciPy are not required.

Fisher's exact, Barnard's exact, Pearson chi-square, and Yates tests are comparisons only.

Assumption: observations are independent and form a valid 2 x 2 table.

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