Homework 5
QMB 3200: Advanced and Quantitative Methods
Fall 2019

Hypothesis testing
T and Z tests

Submitted to
Dr. Jim Dewey
Florida Polytechnic University

Submitted by
Luiz Gustavo Fagundes Malpele
Department of Data Science
Florida Polytechnic University

October 8th, 2019

1. Introduction

The purpose of this report is to investigate the effectiveness of a dietary supplement in reducing the incidence and severity of colds, this project includes descriptive statistics for each variable and also hypothesis testing, Z tests and T tests, investigating the relation of variables. The data includes information regarding the gender, if the person a cold or not and how much time the person was sick, weigh, and if the person had the supplement.

2. Summarized data

The data of the report is below, summarize statistics, such as mean, , standard deviation and frequency, were used to describe the data for 4 different variables: female (gender), cold (if the person had a cold or not), day (the amount of days that the person was sick), supplement (if the person had the supplement of not).

Summarize statistics of the variable Days related to Cold (1)

Days	Summary of Cold		
	Mean	Std. Dev.	Freq.
0	**0**	**0**	**30**
5	**1**	**0**	**3**
6	**1**	**0**	**1**
7	**1**	**0**	**9**
8	**1**	**0**	**4**
9	**1**	**0**	**10**
10	**1**	**0**	**3**
Total	**.5**	**.50421948**	**60**

It can be observed that half of the sample (30 people) did not have a cold, while the other had and from those who had a cold one third (10 people) were sick for the period of 9 days.

Summarize statistics of the variable Supplement related to Cold (2)

Supplement	Summary of Cold Mean	Std. Dev.	Freq.
0	.63333333	.49013252	30
1	.36666667	.49013252	30
Total	.5	.50421948	60

It can be observed that half of the sample (30 people) did not took the supplement and from the people who did not took it, 63% had a cold, while other 30 people had the supplement and from those who had it 37% had a cold.

Summarize statistics of the variable Female related to Cold (3)

Female	Summary of Cold Mean	Std. Dev.	Freq.
0	.56666667	.50400693	30
1	.43333333	.50400693	30
Total	.5	.50421948	60

It can be observed that half of the sample (30 people) are male and from those 57% had a cold, while the other 30 people are female and from those 43% had a cold.

Summarize statistics of the variable Supplement and Female related to Cold (4)

Means, Standard Deviations and Frequencies of Cold

Supplement	Female 0	Female 1	Total
0	.73333333	.53333333	.63333333
	.45773771	.51639778	.49013252
	15	15	30
1	.4	.33333333	.36666667
	.50709255	.48795004	.49013252
	15	15	30
Total	.56666667	.43333333	.5
	.50400693	.50400693	.50421948
	30	30	60

The population was divided into 4 subgroups, each with a population size of 15 people, these 4 groups are: Male x Did have the supplement, Male x Did not have the supplement, Female x Did have the supplement, Female x Did not have the supplement. The table also contains data related to mean and standard deviation for each relation and it can be observed a difference between those who had the supplement and those who did not, but this will be further investigate using hypothesis testing.

Summarize statistics of the variable Cold related to Days (5)

Cold	Summary of Days: Mean	Std. Dev.	Freq.
0	0	0	30
1	7.8666667	1.4558641	30
Total	3.9333333	4.0957467	60

It can be observed that from the population who had a Cold the mean amount day that they were sick was 7.87 days, while the other half of the population was not sick.

Summarize statistics of the variable Supplement related to Days (6)

Supplement	Summary of Days Mean	Std. Dev.	Freq.
0	5.3	4.1948244	30
1	2.5666667	3.5591876	30
Total	3.9333333	4.0957467	60

It can be observed that from the population who had the supplement the mean amount day that they were sick was 2.57 days and the standard deviation was 3.56, while the people who did not have the supplement the mean amount day that they were sick was 5.3 days and the standard deviation was 4.19.

Summarize statistics of the variable Female related to Days (7)

Female	Summary of Days Mean	Std. Dev.	Freq.
0	4.2	3.9075524	30
1	3.6666667	4.3258113	30
Total	3.9333333	4.0957467	60

It can be observed that from the male population that the mean amount day that they were sick was 4.20 days and the standard deviation was 3.90, while from the female population the mean amount day that they were sick was 3.67 days and the standard deviation was 4.33.

Summarize statistics of the variable Female and Supplement related to Days (8)

Means, Standard Deviations and Frequencies of Days

Supplement	Female 0	Female 1	Total
0	5.9333333 3.8446004 15	4.6666667 4.5617457 15	5.3 4.1948244 30
1	2.4666667 3.2263794 15	2.6666667 3.9761192 15	2.5666667 3.5591876 30
Total	4.2 3.9075524 30	3.6666667 4.3258113 30	3.9333333 4.0957467 60

The population was divided into 4 subgroups, each with a population size of 15 people, these 4 groups are: Male x Did have the supplement, Male x Did not have the supplement, Female x Did have the supplement, Female x Did not have the supplement. The table also contains data related to mean and standard deviation for each relation to the variable Days and it can be observed that the people who had the supplement have a mean value smaller than those who did not have the supplement.

2. Z-test for association of variables and cold.

Z-test to check if cold is influenced by the supplement (9)

Two-sample test of proportions — 0: Number of obs = 30; 1: Number of obs = 30

Group	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	.6333333	.0879815			.4608928	.8057739
1	.3666667	.0879815			.1942261	.5391072
diff	.2666667	.1244246			.0227989	.5105344
	under Ho:	.1290994	2.07	0.039		

diff = prop(0) - prop(1) z = 2.0656

Ho: diff = 0

Ha: diff < 0 — Pr(Z < z) = 0.9806

Ha: diff != 0 — Pr(|Z| > |z|) = 0.0389

Ha: diff > 0 — Pr(Z > z) = 0.0194

Assuming Ho: diff = 0, Ha: diff > 0, and $\alpha = 0.05$. The null hypothesis is rejected as the p-value is equal to 0.0194 and $\alpha > 0.0194$. We conclude that supplements affect the probability of getting a cold by decreasing the probability.

Z-test to check if cold is influenced by the supplement for males (10)

Two-sample test of proportions — 0: Number of obs = 15; 1: Number of obs = 15

Group	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	.7333333	.1141798			.5095449	.9571217
1	.4	.1264911			.152082	.647918
diff	.3333333	.1704026			-.0006496	.6673162
	under Ho:	.180944	1.84	0.065		

diff = prop(0) - prop(1) z = 1.8422

Ho: diff = 0

Ha: diff < 0 — Pr(Z < z) = 0.9673

Ha: diff != 0 — Pr(|Z| > |z|) = 0.0654

Ha: diff > 0 — Pr(Z > z) = 0.0327

Assuming Ho: diff = 0, Ha: diff > 0, and α = 0.05. The null hypothesis is rejected as the p-value is equal to 0.0327 and α > 0.0327. We conclude that supplements for men affects getting a cold by decreasing it the probability.

Z-test to check if cold is influenced by the supplement for females (11)

Two-sample test of proportions — 0: Number of obs = 15; 1: Number of obs = 15

Group	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	.5333333	.1288122			.280866	.7858007
1	.3333333	.1217161			.0947741	.5718926
diff	.2	.1772214			-.1473475	.5473475
	under Ho:	.180944	1.11	0.269		

diff = prop(0) - prop(1) z = 1.1053

Ho: diff = 0

Ha: diff < 0 — Pr(Z < z) = 0.8655

Ha: diff != 0 — Pr(|Z| > |z|) = 0.2690

Ha: diff > 0 — Pr(Z > z) = 0.1345

Assuming Ho: diff = 0, Ha: diff > 0, and α = 0.05. The null hypothesis is retained as the p-value is equal to 0.1345 and α < 0.1345. We conclude that there is not enough strong evidence to state that supplements for women by affects getting a cold by decreasing it the probability.

Z-test to check if cold is influenced by gender (12)

Two-sample test of proportions — 0: Number of obs = 30; 1: Number of obs = 30

Group	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	.5666667	.090472			.3893448	.7439886
1	.4333333	.090472			.2560114	.6106552
diff	.1333333	.1279467			-.1174377	.3841044
	under Ho:	.1290994	1.03	0.302		

diff = prop(0) - prop(1) z = 1.0328

Ho: diff = 0

Ha: diff < 0 — Pr(Z < z) = 0.8492

Ha: diff != 0 — Pr(|Z| > |z|) = 0.3017

Ha: diff > 0 — Pr(Z > z) = 0.1508

Assuming Ho: diff = 0, Ha: diff != 0, and $\alpha = 0.05$. The null hypothesis is retained as the p-value is equal to 0.3017 and $\alpha < 0.3017$. We conclude that there is not enough strong evidence to state that gender differentiation affects getting a cold.

Z-test to check if cold is influenced by gender given that supplements are being taken (13)

Two-sample test of proportions — 0: Number of obs = 15; 1: Number of obs = 15

Group	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	.4	.1264911			.152082	.647918
1	.3333333	.1217161			.0947741	.5718926
diff	.0666667	.1755415			-.2773883	.4107217
	under Ho:	.175963	0.38	0.705		

diff = prop(0) - prop(1) z = 0.3789

Ho: diff = 0

Ha: diff < 0 — Pr(Z < z) = 0.6476

Ha: diff != 0 — Pr(|Z| > |z|) = 0.7048

Ha: diff > 0 — Pr(Z > z) = 0.3524

Assuming Ho: diff = 0, Ha: diff != 0, and α = 0.05. The null hypothesis is retained as the p-value is equal to 0.7048 and α < 0.7048. We conclude that there is not enough strong evidence to state that gender differentiation affects getting a cold given that the supplements are being taken.

Z-test to check if cold is influenced gender given that supplements are not being taken (14)

Two-sample test of proportions

0: Number of obs = **15**
1: Number of obs = **15**

Group	Mean	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0	**.7333333**	**.1141798**			**.5095449**	**.9571217**
1	**.5333333**	**.1288122**			**.280866**	**.7858007**
diff	**.2**	**.1721326**			**-.1373737**	**.5373737**
	under Ho:	**.175963**	**1.14**	**0.256**		

diff = prop(**0**) - prop(**1**) z = **1.1366**
Ho: diff = 0

Ha: diff < 0 Pr(Z < z) = **0.8721**
Ha: diff != 0 Pr(|Z| > |z|) = **0.2557**
Ha: diff > 0 Pr(Z > z) = **0.1279**

Assuming Ho: diff = 0, Ha: diff != 0, and α = 0.05. The null hypothesis is retained as the p-value is equal to 0.2557 and α < 0.2557. We conclude that there is not enough strong evidence to state that gender differentiation affects getting a cold given that the supplements are not being taken.

3. T-test for association of variables and cold

T-test to check if cold duration is influenced by the supplement (15)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	19	8.368421	.2560442	1.116071	7.830492	8.90635
1	11	7	.4861724	1.612452	5.91674	8.08326
combined	30	7.866667	.2658032	1.455864	7.323038	8.410295
diff		1.368421	.4982251		.3478532	2.388989

diff = mean(0) - mean(1) t = 2.7466
Ho: diff = 0 degrees of freedom = 28

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.9948 Pr(|T| > |t|) = 0.0104 Pr(T > t) = 0.0052

Assuming Ho: diff = 0, Ha: diff > 0, and α = 0.05. The null hypothesis is rejected as the p-value is equal to 0.0052 and α > 0.0052. We conclude that there is strong evidence to state that supplements decrease the duration of a cold.

T-test to check if cold duration is influenced by the supplement for males (16)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	11	8.090909	.3681538	1.221028	7.270611	8.911207
1	6	6.166667	.5426274	1.32916	4.771799	7.561535
combined	17	7.411765	.3743506	1.543487	6.618177	8.205353
diff		1.924242	.6385125		.5632853	3.2852

diff = mean(0) - mean(1) t = 3.0136
Ho: diff = 0 degrees of freedom = 15

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.9956 Pr(|T| > |t|) = 0.0087 Pr(T > t) = 0.0044

Assuming Ho: diff = 0, Ha: diff > 0, and α = 0.05. The null hypothesis is rejected as the p-value is equal to 0.0044 and α > 0.0044. We conclude that there is strong evidence to state that supplements decrease the duration of a cold for men.

T-test to check if cold duration is influenced by the supplement for females (17)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	8	8.75	.3133916	.8864053	8.008947	9.491053
1	5	8	.6324555	1.414214	6.244022	9.755978
combined	13	8.461538	.312463	1.126601	7.78074	9.142337
diff		.75	.6315565		-.6400465	2.140047

diff = mean(0) - mean(1) t = 1.1875
Ho: diff = 0 degrees of freedom = 11

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.8700 Pr(|T| > |t|) = 0.2600 Pr(T > t) = 0.1300

Assuming Ho: diff = 0, Ha: diff > 0, and α = 0.05. The null hypothesis is retained as the p-value is equal to 0.1300 and α < 0.1300. We conclude that there is not enough strong evidence to state that supplements decrease the duration of a cold for women.

T-test to check if cold duration is influenced by gender (18)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	17	7.411765	.3743506	1.543487	6.618177	8.205353
1	13	8.461538	.312463	1.126601	7.78074	9.142337
combined	30	7.866667	.2658032	1.455864	7.323038	8.410295
diff		-1.049774	.5085647		-2.091521	-.0080261

diff = mean(0) - mean(1) t = -2.0642
Ho: diff = 0 degrees of freedom = 28

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.0242 Pr(|T| > |t|) = 0.0484 Pr(T > t) = 0.9758

Assuming Ho: diff = 0, Ha: diff != 0, and α = 0.05. The null hypothesis is rejected as the p-value is equal to 0.0484 and α < 0.0484. We conclude that there is strong evidence to state that gender differentiation affects a cold duration.

T-test to check if cold duration is influenced by gender given that supplements are being taken (19)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	6	6.166667	.5426274	1.32916	4.771799	7.561535
1	5	8	.6324555	1.414214	6.244022	9.755978
combined	11	7	.4861724	1.612452	5.91674	8.08326
diff		-1.833333	.8281319		-3.706698	.0400312

diff = mean(0) - mean(1) t = -2.2138
Ho: diff = 0 degrees of freedom = 9

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.0271 Pr(|T| > |t|) = 0.0541 Pr(T > t) = 0.9729

Assuming Ho: diff = 0, Ha: diff != 0, and α = 0.05. The null hypothesis is retained as the p-value is equal to 0.0541 and α < 0.0541. We conclude that there is not enough strong evidence to state that gender differentiation affects cold duration given that the supplements are being taken.

T-test to check if cold duration is influenced by gender given that supplements are not being taken (20)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	11	8.090909	.3681538	1.221028	7.270611	8.911207
1	8	8.75	.3133916	.8864053	8.008947	9.491053
combined	19	8.368421	.2560442	1.116071	7.830492	8.90635
diff		-.6590909	.5091231		-1.733247	.415065

diff = mean(0) - mean(1) t = -1.2946
Ho: diff = 0 degrees of freedom = 17

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(T < t) = 0.1064 Pr(|T| > |t|) = 0.2128 Pr(T > t) = 0.8936

Assuming Ho: diff = 0, Ha: diff != 0, and α = 0.05. The null hypothesis is retained as the p-value is equal to 0.2128 and α < 0.2128. We conclude that there is not enough strong evidence to state that gender differentiation affects cold duration given that the supplements are not being taken.

6. Conclusion

Based on the data, it is possible to conclude that cold duration is reduced by the supplement only for men, there is not strong evidence to say the same for women, and cold duration is affected by gender differentiation. Furthermore, it can be said that supplements decrease the probability of getting a cold and that gender is not a factor that affects getting a cold or not, but there is only strong evidence to say that the supplement decreases the probability of men getting a cold.

Appendix A: Do-file-for-Homework 2

```
*QMB 3200 Homework 5

*Name: Luiz Gustavo Fagundes Malpele
log using "C:\Users\luizg\Desktop\LogHW5.smcl"
import delimited "C:\Users\luizg\Desktop\supplement.csv"

*Question 1 - tabulate command

tabulate days, summarize(cold)
tabulate supplement, summarize(cold)
tabulate female, summarize(cold)
tabulate supplement female, summarize(cold)
tabulate cold, summarize(days)
tabulate supplement, summarize(days)
tabulate female, summarize(days)
tabulate supplement female, summarize(days)

*Question 2 - prtest var (if), by(vargroup)

prtest cold, by(female)
prtest cold, by(supplement)
prtest cold if female == 0, by (supplement)
prtest cold if female == 1, by (supplement)
prtest cold if supplement == 1, by (female)
prtest cold if supplement == 0, by (female)

*Question 3 - ttest var (if), by(vargroup)

ttest days if cold == 1, by (supplement)
ttest days if cold == 1 & female == 0, by (supplement)
ttest days if cold == 1 & female == 1, by (supplement)
```

```
ttest days if cold == 1, by (female)
ttest days if cold == 1 & supplement == 0, by (female)
ttest days if cold == 1 & supplement == 1, by (female)

log close
clear
```

Appendix B :Do-file-for-Homework 2

```
name:  <unnamed>
       log:  C:\Users\luizg\Desktop\LogHW5.smcl
  log type:  smcl
 opened on:   8 Oct 2019, 23:38:32

. import delimited "C:\Users\luizg\Desktop\supplement.csv"
(6 vars, 60 obs)

. tabulate days, summarize(cold)

            |           Summary of Cold
       Days |        Mean   Std. Dev.       Freq.
------------+------------------------------------
          0 |           0           0          30
          5 |           1           0           3
          6 |           1           0           1
          7 |           1           0           9
          8 |           1           0           4
          9 |           1           0          10
         10 |           1           0           3
------------+------------------------------------
      Total |          .5   .50421948          60
```

```
. tabulate supplement, summarize(cold)

           |           Summary of Cold
 Supplement |        Mean   Std. Dev.       Freq.
------------+------------------------------------
          0 |   .63333333   .49013252          30
          1 |   .36666667   .49013252          30
------------+------------------------------------
      Total |          .5   .50421948          60

. tabulate female, summarize(cold)

           |           Summary of Cold
     Female |        Mean   Std. Dev.       Freq.
------------+------------------------------------
          0 |   .56666667   .50400693          30
          1 |   .43333333   .50400693          30
------------+------------------------------------
      Total |          .5   .50421948          60

. tabulate supplement female, summarize(cold)

           Means, Standard Deviations and Frequencies
>  of Cold

           |       Female
Supplement |         0          1 |     Total
-----------+----------------------+----------
         0 | .73333333  .53333333 | .63333333
           | .45773771  .51639778 | .49013252
           |        15         15 |        30
```

```
-----------+----------------------+----------
         1 |        .4  .33333333 | .36666667
           | .50709255  .48795004 | .49013252
           |        15         15 |        30
-----------+----------------------+----------
     Total | .56666667  .43333333 |        .5
           | .50400693  .50400693 | .50421948
           |        30         30 |        60
```

```
. tabulate cold, summarize(days)

           |           Summary of Days
      Cold |        Mean   Std. Dev.       Freq.
-----------+------------------------------------
         0 |           0           0          30
         1 |   7.8666667   1.4558641          30
-----------+------------------------------------
     Total |   3.9333333   4.0957467          60
```

```
.
. tabulate suplemment, summarize(days)
variable suplemment not found
r(111);
```

```
. tabulate supplement, summarize(days)

           |           Summary of Days
Supplement |        Mean   Std. Dev.       Freq.
-----------+------------------------------------
         0 |         5.3   4.1948244          30
         1 |   2.5666667   3.5591876          30
-----------+------------------------------------
```

```
      Total |   3.9333333   4.0957467          60

. tabulate female, summarize(days)

           |           Summary of Days
    Female |        Mean   Std. Dev.       Freq.
-----------+------------------------------------
         0 |         4.2   3.9075524          30
         1 |   3.6666667   4.3258113          30
-----------+------------------------------------
      Total |   3.9333333   4.0957467          60

. tabulate supplement female, summarize(days)

           Means, Standard Deviations and Frequencies
>  of Days

           |       Female
Supplement |         0          1 |     Total
-----------+----------------------+----------
         0 | 5.9333333  4.6666667 |       5.3
           | 3.8446004  4.5617457 | 4.1948244
           |        15         15 |        30
-----------+----------------------+----------
         1 | 2.4666667  2.6666667 | 2.5666667
           | 3.2263794  3.9761192 | 3.5591876
           |        15         15 |        30
-----------+----------------------+----------
     Total |       4.2  3.6666667 | 3.9333333
           | 3.9075524  4.3258113 | 4.0957467
           |        30         30 |        60
prtest supplement, by(cold)
```

```
Two-sample test of proportions                      0: Number of obs =       30
                                                    1: Number of obs =       30
------------------------------------------------------------------------------
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |   .6333333   .0879815                      .4608928    .8057739
           1 |   .3666667   .0879815                      .1942261    .5391072
-------------+----------------------------------------------------------------
        diff |   .2666667   .1244246                      .0227989    .5105344
             |  under Ho:   .1290994     2.07   0.039
------------------------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =   2.0656
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.9806         Pr(|Z| > |z|) = 0.0389          Pr(Z > z) = 0.0194

. prtest female, by(cold)

Two-sample test of proportions                      0: Number of obs =       30
                                                    1: Number of obs =       30
------------------------------------------------------------------------------
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |   .5666667    .090472                      .3893448    .7439886
           1 |   .4333333    .090472                      .2560114    .6106552
-------------+----------------------------------------------------------------
```

```
        diff |   .1333333   .1279467                     -.1174377    .3841044
             |  under Ho:   .1290994     1.03   0.302
-------------------------------------------------------------------------------
-
        diff = prop(0) - prop(1)                                  z =   1.0328
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.8492         Pr(|Z| > |z|) = 0.3017          Pr(Z > z) = 0.1508

. prtest cold, by(female)

Two-sample test of proportions                     0: Number of obs =       30
                                                   1: Number of obs =       30
-------------------------------------------------------------------------------
-
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+-----------------------------------------------------------------
-
           0 |   .5666667    .090472                      .3893448    .7439886
           1 |   .4333333    .090472                      .2560114    .6106552
-------------+-----------------------------------------------------------------
-
        diff |   .1333333   .1279467                     -.1174377    .3841044
             |  under Ho:   .1290994     1.03   0.302
-------------------------------------------------------------------------------
-
        diff = prop(0) - prop(1)                                  z =   1.0328
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.8492         Pr(|Z| > |z|) = 0.3017          Pr(Z > z) = 0.1508

. prtest supplement, by(supplement)
```

```
Two-sample test of proportions                      0: Number of obs =       30
                                                    1: Number of obs =       30
------------------------------------------------------------------------------
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |          0          0                              0           0
           1 |          1          0                              1           1
-------------+----------------------------------------------------------------
        diff |         -1          0                             -1          -1
             |  under Ho:   .1290994    -7.75   0.000
------------------------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =  -7.7460
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.0000         Pr(|Z| > |z|) = 0.0000          Pr(Z > z) = 1.0000

. prtest cold, by(supplement)

Two-sample test of proportions                      0: Number of obs =       30
                                                    1: Number of obs =       30
------------------------------------------------------------------------------
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |   .6333333   .0879815                      .4608928    .8057739
           1 |   .3666667   .0879815                      .1942261    .5391072
-------------+----------------------------------------------------------------
```

```
        diff |   .2666667   .1244246                      .0227989    .5105344
             |  under Ho:   .1290994     2.07   0.039
------------------------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =   2.0656
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.9806         Pr(|Z| > |z|) = 0.0389          Pr(Z > z) = 0.0194

. prtest cold, by(female = 1)
by() does not contain a valid varname
r(198);

. prtest help
variable help not found
r(111);

. help prtest

. prtest cold if female = 0, by (supplement)
may not combine == and option by()
r(198);

. prtest cold if female == 0, by (supplement)

Two-sample test of proportions                     0: Number of obs =       15
                                                   1: Number of obs =       15
------------------------------------------------------------------------------
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
           0 |   .7333333   .1141798                      .5095449    .9571217
           1 |         .4   .1264911                       .152082     .647918
-------------+------------------------------------------------------------------
-
        diff |   .3333333   .1704026                     -.0006496    .6673162
             |  under Ho:    .180944     1.84   0.065
------------------------------------------------------------------------------
-
        diff = prop(0) - prop(1)                                      z =   1.8422
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.9673         Pr(|Z| > |z|) = 0.0654          Pr(Z > z) = 0.0327

. prtest cold if female == 1, by (supplement)

Two-sample test of proportions                     0: Number of obs =       15
                                                   1: Number of obs =       15
------------------------------------------------------------------------------
-
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
-
           0 |   .5333333   .1288122                      .280866    .7858007
           1 |   .3333333   .1217161                     .0947741    .5718926
-------------+----------------------------------------------------------------
-
        diff |         .2   .1772214                     -.1473475    .5473475
             |  under Ho:    .180944     1.11   0.269
------------------------------------------------------------------------------
-
        diff = prop(0) - prop(1)                                      z =   1.1053
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
```

```
 Pr(Z < z) = 0.8655         Pr(|Z| > |z|) = 0.2690          Pr(Z > z) = 0.1345

. prtest cold if supplement == 1, by (female)

Two-sample test of proportions                     0: Number of obs =       15
                                                   1: Number of obs =       15
------------------------------------------------------------------------------
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |         .4   .1264911                       .152082     .647918
           1 |   .3333333   .1217161                      .0947741    .5718926
-------------+----------------------------------------------------------------
        diff |   .0666667   .1755415                     -.2773883    .4107217
             |  under Ho:    .175963     0.38   0.705
------------------------------------------------------------------------------
        diff = prop(0) - prop(1)                                  z =   0.3789
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.6476         Pr(|Z| > |z|) = 0.7048          Pr(Z > z) = 0.3524

. prtest cold if supplement == 0, by (female)

Two-sample test of proportions                     0: Number of obs =       15
                                                   1: Number of obs =       15
------------------------------------------------------------------------------
       Group |       Mean   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           0 |   .7333333   .1141798                      .5095449    .9571217
```

```
           1 |   .5333333   .1288122                      .280866    .7858007
-------------+------------------------------------------------------------------
-
        diff |         .2   .1721326                     -.1373737    .5373737
             |  under Ho:    .175963     1.14   0.256
-------------------------------------------------------------------------------
-
        diff = prop(0) - prop(1)                                      z =   1.1366
    Ho: diff = 0

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(Z < z) = 0.8721         Pr(|Z| > |z|) = 0.2557          Pr(Z > z) = 0.1279
ttest days if cold == 1, by (supplement)

Two-sample t test with equal variances
------------------------------------------------------------------------------
-
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
-
       0 |      19    8.368421    .2560442    1.116071    7.830492     8.90635
       1 |      11           7    .4861724    1.612452     5.91674     8.08326
---------+--------------------------------------------------------------------
-
combined |      30    7.866667    .2658032    1.455864    7.323038    8.410295
---------+--------------------------------------------------------------------
-
    diff |            1.368421    .4982251                .3478532    2.388989
------------------------------------------------------------------------------
-
    diff = mean(0) - mean(1)                                      t =   2.7466
Ho: diff = 0                                     degrees of freedom =       28

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9948         Pr(|T| > |t|) = 0.0104          Pr(T > t) = 0.0052
```

```
. ttest days if cold == 1, by (female)

Two-sample t test with equal variances
------------------------------------------------------
> ------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev
> .
>     [95% Conf. Interval]
---------+--------------------------------------------
> ------------------------
       0 |      17    7.411765    .3743506    1.543487
>     6.618177
>                 8.205353
       1 |      13    8.461538     .312463    1.126601
>      7.78074
>                 9.142337
---------+--------------------------------------------
> ------------------------
combined |      30    7.866667    .2658032    1.455864
>     7.323038
>                 8.410295
---------+--------------------------------------------
> ------------------------
    diff |           -1.049774    .5085647
>    -2.091521
>                -.0080261
------------------------------------------------------
> ------------------------
    diff = mean(0) - mean(1)
>             t =  -2.0642
Ho: diff = 0                                     degre
```

```
> es of freedom =       28

    Ha: diff < 0                 Ha: diff != 0
>          Ha: diff > 0
 Pr(T < t) = 0.0242         Pr(|T| > |t|) = 0.0484
>       Pr(T > t) = 0.9758

. ttest days if cold == 1, by (female)

Two-sample t test with equal variances
------------------------------------------------------------------------------
-
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
-
       0 |      17    7.411765    .3743506    1.543487    6.618177    8.205353
       1 |      13    8.461538     .312463    1.126601     7.78074    9.142337
---------+--------------------------------------------------------------------
-
combined |      30    7.866667    .2658032    1.455864    7.323038    8.410295
---------+--------------------------------------------------------------------
-
    diff |           -1.049774    .5085647               -2.091521   -.0080261
------------------------------------------------------------------------------
-
    diff = mean(0) - mean(1)                                      t =  -2.0642
Ho: diff = 0                                     degrees of freedom =       28

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0242         Pr(|T| > |t|) = 0.0484          Pr(T > t) = 0.9758

. ttest days if cold == 1 & female == 0, by (female)
1 group found, 2 required
r(420);
```

```
. help ttest

. ttest days if female == 0, by (female)
1 group found, 2 required
r(420);

. ttest days if cold == 1, by (female if female == 0)
by() does not contain a valid varname
r(198);

. ttest days if cold == 1, by (female) [if female ==0]
option [ not allowed
r(198);

. ttest help
variable help not found
r(111);

. help ttest

. ttest days if cold == 1, by (supplements)
variable supplements not found
(error in option by())
r(111);

. ttest days if cold == 1, by (supplement)

Two-sample t test with equal variances
------------------------------------------------------------------------------
-
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
```

```
---------+--------------------------------------------------------------------
-
       0 |      19    8.368421    .2560442    1.116071    7.830492     8.90635
       1 |      11           7    .4861724    1.612452     5.91674     8.08326
---------+--------------------------------------------------------------------
-
combined |      30    7.866667    .2658032    1.455864    7.323038    8.410295
---------+--------------------------------------------------------------------
-
    diff |            1.368421    .4982251                .3478532    2.388989
------------------------------------------------------------------------------
-
    diff = mean(0) - mean(1)                                      t =   2.7466
Ho: diff = 0                                     degrees of freedom =       28

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9948         Pr(|T| > |t|) = 0.0104          Pr(T > t) = 0.0052

. ttest days if cold == 1 & female == 0, by (supplement)

Two-sample t test with equal variances
------------------------------------------------------------------------------
-
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
-
       0 |      11    8.090909    .3681538    1.221028    7.270611    8.911207
       1 |       6    6.166667    .5426274     1.32916    4.771799    7.561535
---------+--------------------------------------------------------------------
-
combined |      17    7.411765    .3743506    1.543487    6.618177    8.205353
---------+--------------------------------------------------------------------
-
    diff |            1.924242    .6385125                .5632853      3.2852
------------------------------------------------------------------------------
-
```

```
    diff = mean(0) - mean(1)                                      t =   3.0136
Ho: diff = 0                                     degrees of freedom =       15

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9956         Pr(|T| > |t|) = 0.0087          Pr(T > t) = 0.0044

. ttest days if cold == 1 & female == 1, by (supplement)

Two-sample t test with equal variances

------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |       8        8.75    .3133916    .8864053    8.008947    9.491053
       1 |       5           8    .6324555    1.414214    6.244022    9.755978
---------+--------------------------------------------------------------------
combined |      13    8.461538     .312463    1.126601     7.78074    9.142337
---------+--------------------------------------------------------------------
    diff |                .75    .6315565               -.6400465    2.140047
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   1.1875
Ho: diff = 0                                     degrees of freedom =       11

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.8700         Pr(|T| > |t|) = 0.2600          Pr(T > t) = 0.1300

. ttest days if cold == 1, by (female)

Two-sample t test with equal variances

------------------------------------------------------------------------------
```

```
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      17    7.411765    .3743506    1.543487    6.618177    8.205353
       1 |      13    8.461538     .312463    1.126601     7.78074    9.142337
---------+--------------------------------------------------------------------
combined |      30    7.866667    .2658032    1.455864    7.323038    8.410295
---------+--------------------------------------------------------------------
    diff |           -1.049774    .5085647               -2.091521   -.0080261
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -2.0642
Ho: diff = 0                                     degrees of freedom =       28

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0242         Pr(|T| > |t|) = 0.0484          Pr(T > t) = 0.9758

. ttest days if cold == 1 & supplement == 0, by (female)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      11    8.090909    .3681538    1.221028    7.270611    8.911207
       1 |       8        8.75    .3133916    .8864053    8.008947    9.491053
---------+--------------------------------------------------------------------
combined |      19    8.368421    .2560442    1.116071    7.830492     8.90635
---------+--------------------------------------------------------------------
    diff |           -.6590909    .5091231               -1.733247     .415065
```

```
------------------------------------------------------------------------------
-
    diff = mean(0) - mean(1)                                      t =  -1.2946
Ho: diff = 0                                     degrees of freedom =       17

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.1064         Pr(|T| > |t|) = 0.2128          Pr(T > t) = 0.8936

. ttest days if cold == 1 & supplement == 1, by (female)

Two-sample t test with equal variances
------------------------------------------------------------------------------
-
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
-
       0 |       6    6.166667    .5426274     1.32916    4.771799    7.561535
       1 |       5           8    .6324555    1.414214    6.244022    9.755978
---------+--------------------------------------------------------------------
-
combined |      11           7    .4861724    1.612452     5.91674     8.08326
---------+--------------------------------------------------------------------
-
    diff |          -1.833333    .8281319               -3.706698    .0400312
------------------------------------------------------------------------------
-
    diff = mean(0) - mean(1)                                      t =  -2.2138
Ho: diff = 0                                     degrees of freedom =        9

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0271         Pr(|T| > |t|) = 0.0541          Pr(T > t) = 0.9729
```