Assignment 6

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QMB 3200 ~ Advanced Quantitative Methods

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“If I were to nitpick, I'd say work on the cover page a little.”

-- Christopher Willman, Oct 6 at 2:36pm

Picture from https://favpng.com/png_user/artzimer

Executive Summary

This assignment explored data on the use of a dietary supplement to reduce susceptibility to a cold and to reduce the number of days with cold symptoms. By using proportion and t-tests on the data, we can see how effective the supplement is among the population. We found that the supplement is not always effective and does not appear to be very effective and recommend that it be further improved before being sent out to market.

Introduction and Background

Assignment 6 allows students in QMB 3200 ~ Advanced Quantitative Methods to take a deeper dive into using Stata and hypothesis testing in Stata. The data provided represents a study conducted where respondents may take a dietary supplement to test whether or not the supplement has any effect on the incidence and severity of colds over the course of two months.

Data

The data used was supplied by the professor of the class and is called “supplement.csv”. The file contains data for 60 participants, 30 male and 30 female, with data for the subject number, gender, whether or not they took the supplement, whether or not they had a cold, the number of days they had a cold, and their body weight in pounds. Where data is binary, 1 always matches the variable name while 0 is the opposite.

Table 1: Tabulation of Having a Cold by Gender and Supplement Use

```
tabulate female supplement, summarize(cold)

          Means, Standard Deviations and Frequencies of Cold

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

Table 2: Tabulation of Days of Having a Cold by Gender and Supplement Use

```
tabulate female supplement, summarize(days)

          Means, Standard Deviations and Frequencies of Days

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

Table 1 shows the mean number, standard deviation, and frequencies of colds by gender and supplement use. The table suggests that fewer women had colds than men did both with and without the supplement and that both genders taking the supplement saw fewer colds than those not taking it.

Table 2 shows the mean number, standard deviation, and frequencies of the number of days that people had a cold. This table suggests that when a woman caught a cold, she had it for fewer days than a man would if he caught a cold. However, the average number of days is very similar between the two genders when they were taking the supplement. The average number of days with the supplement was also several days lower than those without the supplement.

Analysis and Discussion

When claims like the ones made in the data section are made, it is important to back them up with the appropriate statistical tests.

Table 3: Proportion Test of Having a Cold by Supplement Use

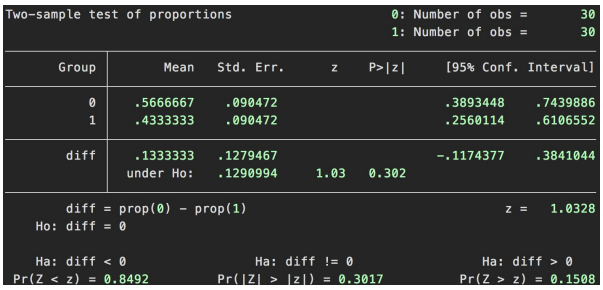
```
. prtest cold, by(supplement)

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
```

Table 4: Proportion Test of Having a Cold by Supplement Use by Gender

```
. by female, sort : prtest cold, by(supplement)

-> female = 0

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

-> female = 1

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
```

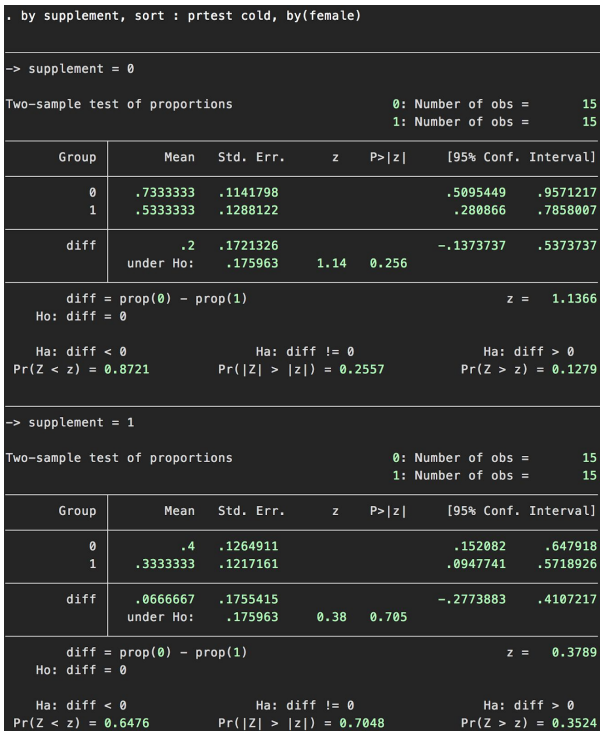
Our null hypothesis is that the number of people that got a cold both with and without the supplement is the same while the alternative hypothesis is that those taking the supplement were less likely to get a cold. With a p-value less than .05, it is safe to reject the null hypothesis and accept the alternative that taking the supplement makes you less susceptible to catching a cold. When splitting the data by gender, the p-value remains less than .05 for men while it increases to above .05 for women. This means we retain the null hypothesis that the supplement makes no difference for women.

Table 5: Proportion Test of Having a Cold by Gender



```
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
```

Table 6: Proportion Test of Having a Cold by Gender by Supplement Use



```
. by supplement, sort : prtest cold, by(female)

-> supplement = 0

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


-> supplement = 1

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
```

When running a proportion test to see if men and women caught a cold at a similar rate such as in Table 5, the p-value was .3017 which is higher than our critical value of .05. Thus we retain our null hypothesis that men and women caught a cold at a similar rate. When comparing rates between genders it is important to also isolate the supplement variable such as in Table 6. When this is done, the p-values for both those taking and not taking the supplement is over .05 which means we retain our null hypothesis that the supplement has no effect in susceptibility to catching a cold.

Rather than compare the sample is representative of the population, we can test subsets of the data against each other using a t-test.

Table 7: T-test of Days with a Cold by Supplement Use

```
. 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
```

Table 8: T-test of Days with a Cold by Supplement Use by Gender

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

-> female = 0

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

-> female = 1

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
```

Following a similar style of hypothesis test as before where the null is that the supplement has no effect and the alternative is that the supplement does have an effect, we can compare p-values for Tables 7 and 8. For Table 7 with both genders and the male portion of Table 8, the p-value is less than .05 which means that we reject our null hypothesis that the supplement had no effect and accept the alternative that the supplement makes a difference. For the female portion of Table 8, the p-value is greater than .05 and so we accept the null hypothesis that the supplement has no effect. Because supplement effectiveness appears to be influenced by gender, it is a good idea to test that specifically as well.

Table 9: T-test of Days with a Cold by Gender

```
. 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
```

Table 10: T-test of Days with a Cold by Gender by Supplement

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

-> supplement = 0

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

-> supplement = 1

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
```

For those that got a cold, the t-test in Table 9 shows that the average number of days with symptoms is influenced by gender because it has a p-value less than .05 which means we accept the alternative that they are different. While in Table 10 both p-values are above .05 and would indicate that males and females had similar length colds with and without the supplement, the p-value for those taking the supplement is very close to being less than .05. This suggests that it could be that for those taking the supplement, the number of days with a cold is different for men and women.

Conclusion

This assignment helped students come to terms with Stata's awful interface, command structure, and everything else while also providing a cool exploration into the data itself. By using proportion tests to get a feel for the data, we knew where to look and how to examine the data with t-tests to learn whether or not the supplement was effective. We found that while the supplement is effective, it is not very effective in all cases. The supplement should be improved before being sent to market so it is more effective for everyone.

Appendix

1 Summary statistics

```
tabulate female supplement, summarize(cold)

          Means, Standard Deviations and Frequencies of Cold

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

```
tabulate female supplement, summarize(days)

          Means, Standard Deviations and Frequencies of Days

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

2 Using prtest

```
. 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
```

```
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
```

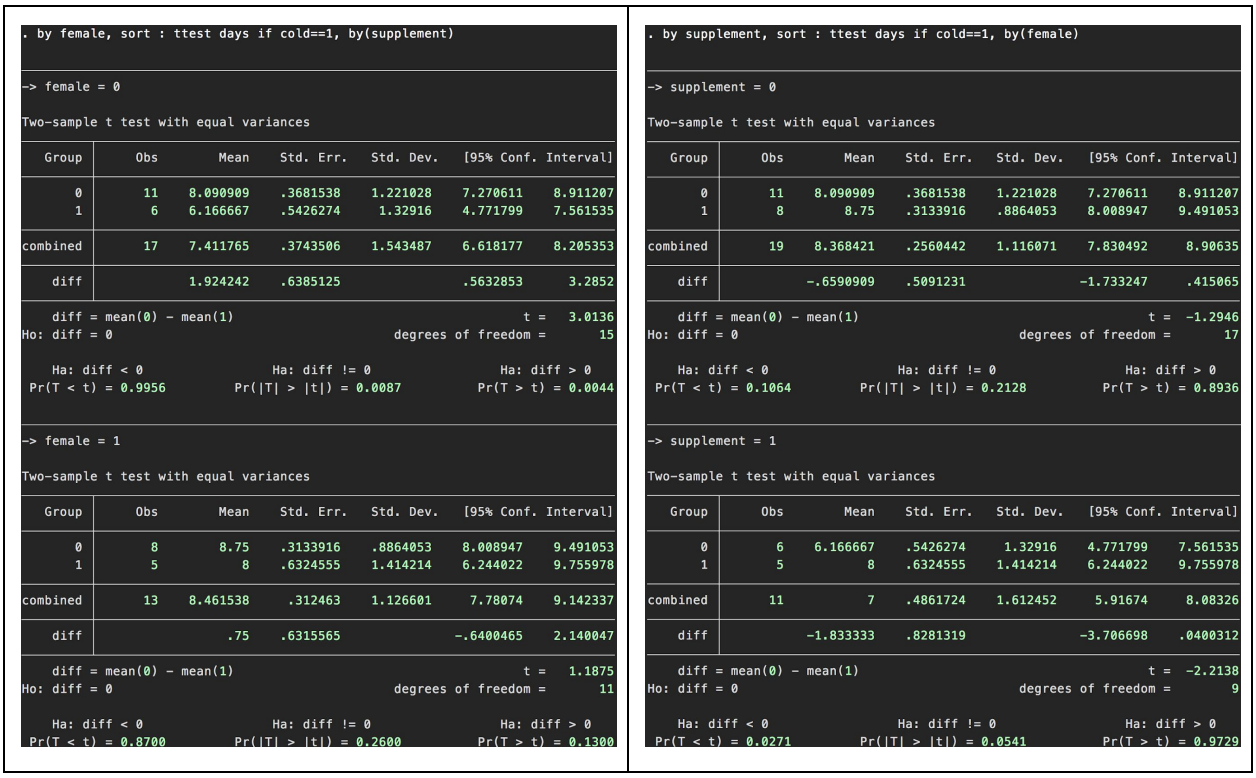
```
. by female, sort : prtest cold, by(supplement)

-> female = 0

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

-> female = 1

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
```

```
. by supplement, sort : prtest cold, by(female)

-> supplement = 0

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

-> supplement = 1

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
```

3 t-test

```
. 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                     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
```



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

-> female = 0

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

-> female = 1

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
```

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

-> supplement = 0

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

-> supplement = 1

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
```

Stata do-file

```
capture log close
log using gus_lipkin_Assignment_6, replace
import delimited "/Users/guslipkin/Documents/Fall2020/QMB 3200 ~
Advanced Quantitative Methods/Assignment 6/supplement.csv"
clear all

*1
tabulate female supplement, summarize(days)
tabulate female supplement, summarize(cold)

*2a
prtest cold, by(supplement)
*2b
by female, sort : prtest cold, by(supplement)
*2c
prtest cold, by(female)
*2d
by supplement, sort : prtest cold, by(female)
```

```
*3a
ttest days if cold==1, by(supplement)
*3b
by female, sort : ttest days if cold==1, by(supplement)
*3c
ttest days if cold==1, by(female)
*3d
by supplement, sort : ttest days if cold==1, by(female)

log close
```