MWSUG 2003
A Macro Program for Displaying T-test Results
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Abstract

The Student's t-test is one of the most common statistical tests used to compare the means (or proportions) of two independent groups. However, the standard SAS® output from PROC TTEST proves to be cumbersome for identifying and displaying the most meaningful results. This paper illustrates the use of a macro program as a means to highlight the key statistical output from PROC TTEST. It can also serve as a model for customizing the output of most other SAS procedures. The intermediate SAS user should come away with a better appreciation of (1) the manipulation of ODS output objects to select and assess selected output fields and (2) the use of macros to automate the entire process to facilitate repeated runs.

Standard PROC TTEST Output: Too Much of a Good Thing

Standard PROC TTEST output, while providing vital information (including results with which to judge the appropriateness of the particular t-test), does not make it easy for the user to discern such key results as the groups' means and the statistical significance of the intergroup difference of means.

For example, consider standard SAS output for a PROC TTEST (using a sample data set) comparing the proportions of drivers ticketed for reckless driving in two groups of Washington State drivers: (1) drivers ticketed by an aggressive driving apprehension team (ADAT) and (2) a control sample of drivers ticketed by other law enforcement patrols in the same counties patrolled by ADAT (COUNTY) (see Output #1).

The output provides more information than the typical user requires. For example, seven consecutive columns display the following statistics: Lower Confidence Limit (CL) Mean, Mean, Upper CL Mean, Lower CL Standard Deviation, Standard Deviation, Upper CL Standard Deviation, and Standard Error. Typically, the user is interested only in the mean and standard deviation results.

The typical user also wants to determine the statistical significance of the intergroup difference of means. For this we need to look at the results of the F-test of the intergroup difference in distribution variances (found in the "Pr > F" column in the "Equality of Variances" section of the output). Based on the F-test results, we must then locate the results for the appropriate t-test method ("Pooled" for equal variances, "Satterthwaite" for unequal variances) to determine the correct statistical significance of the T-statistic (in the "Pr > |t|" column in the "TTests" section).

Interpreting t-test results from standard output is especially cumbersome if the output contains a long series of t-test results, which can occur if one is comparing a series of dependent variables (e.g., various types of traffic violations) or a variety of different groups.

This paper presents an alternative method, using a macro, to generate output that summarizes t-test results (for a single test or series of tests) in an easily readable format.
Two points should be made up front. First, limiting printed output to “key statistics” should not be seen as an excuse to avoid surveying the entire output to judge the appropriateness of a statistical test (e.g., are the assumptions of the test being met?). Second, while the creation of macros such as this might seem onerous, it will prove to be time well spent if you need to run the macro frequently.

Identifying the Key Output Fields
The essential statistics we typically want to draw out of the standard PROC TTEST output (see Output #1) are:

1. The dependent variable being measured (in our example, proportion of drivers given citations for Reckless Driving);
2. The two groups being compared (ADAT and County drivers);
3. The sample sizes (885 for ADAT drivers and 448 for County drivers);
4. The group means or proportions (2.26% for ADAT drivers and 0.89% for County drivers);
5. The group standard deviations (0.1487 for ADAT drivers and 0.0942 for County drivers);
6. The probability or significance, level results of the F-test for equality of variances (Prob(F) < .0001, which is sufficiently small to reject the null hypothesis that the variances are equal);
7. The appropriate method of t-test (Satterthwaite) based on the results of the F-test (which found the variances to be unequal); and
8. The probability, or significance, level of the appropriate t-test result for the intergroup difference of means/proportions (Prob(t) = 0.413).

Beginning the Program

```sas
/* Begining of Macro Program and Its Parameters */
title MWSUG 2003 Conference;
title2 Macro Program for Displaying T-test Results - Brent Baxter;
title3; * Blank line for spacing in title;
libname Traffic "C:MWSUG2003";
```

Assigning Macro Variables to Represent Our Comparison Groups (Optional)

A first, though optional, step is to use macro variables to define the two groups we will be comparing in the t-test(s). I’ve chosen to use the macro language “%let” command to assign the names of my two groups of drivers (ADAT and County) to the macro variables “Group1” and “Group2”.

```sas
%let group1 = ADAT;
%let group2 = County;
```

Defining these macro variables will allow me to subsequently reference, for example, my first group (ADAT), by calling the macro variable with the phrase “&group1”. This makes it convenient if I later want to change my designation of comparison groups. For example, I can change my second group to a statewide sample of drivers with a single change in my program by redefining the appropriate macro variable (%let group2 = State).

Writing the Macro

The next task is to create our macro. The macro, once called, will perform a t-test on a selected type of traffic violation (or any other numeric variable) and manipulate the output to present the results in an easily readable format.

Macro Parameters

Our macro (I’ve named it “TT”) uses macro parameters (unassigned variables listed within the parentheses in the first line of the macro). This allows us to assign
values to these parameters each time we
call the macro.

%macro TT (Item, itemlabel, class, group1,
group2, plevel, datafile);

Note that there is no need for a DATA
statement prior to the macro, since the
macro contains all the DATA steps we
need for our task.

Macro Step #1: Perform t-test on
selected variable and output the results
(as ODS output objects) into separate
output data sets.

The first step within the macro is to
perform the t-test and output the three
resulting "ODS tables" (Statistics, TTtests,
and Equality), containing what are called
"ODS output objects," into separate output
data sets (which I’ve named "TStats",
"TTests" and "TEqual", respectively).
These results (or "objects") are created
and saved as sets of variables which can
be referenced and manipulated essentially
like any other SAS variable (see Output #2
for listings of the three output data sets).
(To discover the ODS tables for whatever
procedure you’re running, insert the "ODS
TRACE ON" command into your
program just prior to the procedure.)

* Output #1;
proc ttest data=&datafile;
class &class;
var &item;
title4 "T-test Results for &itemlabel";
ods output
Statistics = TStats
TTests = TTests
Equality = TEqual;
run;
title4; * To clear 4th line of title heading until reassigned;

* Output #2;
proc print data=TStats heading=h;
title4 "PROC PRINT of 'TStats' Output Data
Set"; run;
proc print data=TTests heading=h;
title4 "PROC PRINT of 'TTests' Output Data
Set"; run;
proc print data=TEqual heading=h;
title4 "PROC PRINT of 'TEqual' Output Data
Set"; run;

Macro Step #2: Create merged output
data set.

Next we create a data set ("AllStats")
containing all the ODS output objects from
the t-test by merging the three individual
output data sets (TStats, TTests, TEqual).
Since there are two different variables
(objects) named "Method" (one in the
"TTests" dataset, another in the "TEqual"
data set), I’ll first assign their values to two
new variables ("TMethod" and "FMethod,"
respectively) to distinguish them in the
merged data set (see Output #3 for a
listing of the merged output data set).

data TTests; set TTests; TMethod = Method; run;
data TEqual; set TEqual; FMethod = Method;
run;

* Output #3;
data AllStats; merge TStats TTests TEqual;
proc print data=AllStats;
title4 "PROC PRINT of 'AllStats' Output
Data Set";
run;
title4;

Note that the merged output data set
(AllStats) contains three observations.
The first observation contains results on
Group 1 (ADAT), the Pooled t-test method
(for equal variances) and the F-test. The
second observation has results on Group
2 (County) and the Satterthwaite t-test
method (for unequal variances). The third
observation (which we won’t be using)
contains statistics on the difference of
means/proportions.

Macro Step #3: Assign relevant results.

Next we manipulate the saved output (in
the AllStats data set) to assign (in
appropriate format) specific output values
(e.g., mean, standard deviation) to their
appropriate comparison group (ADAT,
County) and assign the appropriate t-test
significance result to a new variable I’ll
name "TStatSignif". We can also delete
the third observation in AllStats, since we won’t be needing the results it contains.

**Macro Step #4: Determine appropriate t-test method.**

We next ascertain the appropriate t-test method (Pooled or Satterthwaite) on the basis of the F-test (difference in variance) results.

```plaintext
if ProbF lt .05 and Variances = "Unequal" then
TStatSignif = Probt;

if ProbF ge .05 and Variances = "Equal" then
TStatSignif = Probt;
```

**Macro Step #5: Collect and retain key results from first observation.**

In order to merge the appropriate t-test results into one observation for printing, we need to retain the key results (Group 1 statistics and TStatSignif) contained in the first observation in AllStats.

```plaintext
data AllStats;
set AllStats;
if compress(Class) = "&group1" then do;
    HoldG1N = &group1.N;
    HoldG1Yes = round (N * Mean);
    HoldG1Percent = Mean * 100;
    HoldG1SD = StdDev;
end;
else if compress(Class) = "&group2" then do;
    HoldG2N = N;
    HoldG2Yes = round (N * Mean);
    HoldG2Percent = Mean * 100;
    HoldG2SD = StdDev;
end;
else delete;
```

**Macro Step #6: Combine key results into single observation.**

We can then combine all appropriate t-test results in one convenient observation in a new output data set ("KeyStats"). We can do this by copying the retained results from the first observation in AllStats into the second observation and then keeping only the second observation. We then have all the t-test results we need in a single observation (see Output #4 for a listing of the observation).

```plaintext
data KeyStats;
set AllStats;
length ViolationType $36;
ViolationType = "&itemlabel";
if &group1.N = . then &group1.N = HoldG1N;
if &group1.Yes = . then &group1.Yes = HoldG1Yes;
if &group1.Percent = . then &group1.Percent = HoldG1Percent;
if &group1.SD = . then &group1.SD = HoldG1SD;
if TStatSignif = . then TStatSignif = HoldSST;
if &group2.N = . then delete;
* Output #4;
proc print data=KeyStats;
title4 PROC PRINT of Single Observation Containing T-test Results;
run;
title4;
```

**Macro Step #7 (Optional): Create a variable that describes the level of statistical significance.**

To make it easier to discern statistical significance in a series of t-test results, we chose to construct a variable ("SignifLevel") that categorizes each test’s statistical significance into an appropriate level. For example, a statistical significance of 0.0413 could be classified as a level of "p < .05." Notice that we’re using the values of a particular ODS output object (TStatSignif) to do the necessary computations for us.

```plaintext
data KeyStats;
set KeyStats;
length SignifLevel $16;
if TStatSignif ne . and TStatSignif < &plevel then do;
```
Calling the Macro

Having written the macro, we can now "call" the macro with a "%TT" command. Our macro call will invoke the execution of all commands within the macro text (between "%macro TT" and "%mend TT"). Executing the "TT" macro program for a t-test of Reckless Driving will produce Outputs #1 through #5.

%tt (item=RecklessDriving, itemlabel=Reckless Driving, class=Group, group1=ADAT, group2=&Group2, plevel=.10, datafile=TrafficViolations);

Repeated Macro Calls Enhance Summary Output

In addition, by calling the "TT" macro program repeatedly using different macro parameters, we can produce a data set ("AllViolations") that summarizes the key statistics for an entire series of t-tests (e.g., for different types of traffic violations). We can then print a listing from the AllViolations data set that summarizes the key results from our series of t-tests (see Output #6).

%tt (item=RecklessDriving, itemlabel=Reckless Driving, class=Group, group1=ADAT, group2=&Group2, plevel=.10, datafile=TrafficViolations);
%tt (item=VioINOV, itemlabel=Carpool Lane Violation, class=Group, group1=&Group1, group2=&Group2, plevel=.10, datafile=TrafficViolations);
%tt (item=VioICrossBarrler, itemlabel=Crossing Physical Barrier, class=Group, group1=&Group1, group2=&Group2, plevel=.10, datafile=TrafficViolations);
%tt (item=VioIDlsobeyTCD, itemlabel=Disobey Traffic Control Device, class=Group, group1=&Group1, group2=&Group2, plevel=.10, datafile=TrafficViolations);
... (Additional calls for various types of violations)

%tt (item=VioISpeed, itemlabel=Speeding, class=Group, group1=group1, group2=group2, plevel=.10, datafile=TrafficViolations);
Conclusion

By comparing standard PROC TTEST output (such as in Output #1 in this paper) versus summarized output of key t-test statistics (Output #5), the SAS user will hopefully appreciate the advantages of capturing and manipulating ODS output objects to customize SAS results. Furthermore, comparing multiple instances of standard t-test output versus a customized summary of multiple t-test results (Output #6) should reveal the advantages of creating a macro to automate the process of summarizing results. The user is encouraged to try this approach with the output of other SAS procedures as well.

Acknowledgements

All examples of SAS programs and output in this paper were generated using SAS version 8.02 in a Windows® XP® environment. I would like to acknowledge my use of Art Carpenter’s excellent book on macros, Carpenter’s Complete Guide to the SAS® Macro Language (SAS Institute, Inc., 1998), which I found helpful in preparing this paper. Thanks also to the Washington State Department of Licensing for providing the raw data (from a study funded by the Washington State Traffic Safety Commission) which generated the examples used in this paper.

Contact Information

Comments, suggestions and questions are welcome. Please contact the author:

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### OUTPUT #1: Standard PROC TTEST Output (with Highlights)

MWSUG 2003 Conference  
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T-test Results for Reckless Driving  

The TTEST Procedure

**Statistics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>N</th>
<th>Lower CL Mean</th>
<th>Mean</th>
<th>Upper CL Mean</th>
<th>Lower CL Std Dev</th>
<th>Mean Std Dev</th>
<th>Upper CL Std Dev</th>
<th>Std Err</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>RecklessDriving</td>
<td>ADAT</td>
<td>885</td>
<td>0.0128</td>
<td>0.0226</td>
<td>0.0324</td>
<td>0.1421</td>
<td>0.1487</td>
<td>0.156</td>
<td>0.005</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>RecklessDriving</td>
<td>County</td>
<td>448</td>
<td>0.0002</td>
<td>0.0089</td>
<td>0.0177</td>
<td>0.0884</td>
<td>0.0942</td>
<td>0.1008</td>
<td>0.0044</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>RecklessDriving</td>
<td>Diff (1-2)</td>
<td></td>
<td>-0.001</td>
<td>0.0137</td>
<td>0.0288</td>
<td>0.128</td>
<td>0.1329</td>
<td>0.1382</td>
<td>0.0077</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**T-Tests**

| Variable         | Method       | Variances  | DF  | t Value | Pr > |t| |         |         |
|------------------|--------------|------------|-----|---------|------|-----|-------|---------|
| RecklessDriving  | Pooled       | Equal      | 1331| 1.77    | 0.0763|     |       |         |
| RecklessDriving  | Satterthwaite| Unequal    | 1267| 2.04    | 0.0413|     |       |         |

**Equality of Variances**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Method</th>
<th>Num DF</th>
<th>Den DF</th>
<th>F Value</th>
<th>Pr &gt; F</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RecklessDriving</td>
<td>Folded F</td>
<td>884</td>
<td>447</td>
<td>2.49</td>
<td>&lt;.0001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## OUTPUT #2: Contents of Separate Output Data Sets Containing ODS Output Objects

### MWSUG 2003 Conference
Macro Program for Displaying T-test Results - Brent Baxter

PROC PRINT of 'TStats' Output Data Set

<table>
<thead>
<tr>
<th>Obs</th>
<th>Variable</th>
<th>Class</th>
<th>N</th>
<th>Lower CLMean</th>
<th>Mean</th>
<th>Upper CLMean</th>
<th>Lower CLStdDev</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RecklessDriving</td>
<td>ADAT</td>
<td>885</td>
<td>0.0128</td>
<td>0.0226</td>
<td>0.0324</td>
<td>0.1421</td>
</tr>
<tr>
<td>2</td>
<td>RecklessDriving</td>
<td>County</td>
<td>448</td>
<td>0.0002</td>
<td>0.0089</td>
<td>0.0177</td>
<td>0.0884</td>
</tr>
<tr>
<td>3</td>
<td>RecklessDriving</td>
<td>Diff (1-2)</td>
<td>-0.001</td>
<td>0.0137</td>
<td>0.0288</td>
<td></td>
<td>0.128</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obs</th>
<th>UMPULower CLStdDev</th>
<th>UMPUUpper CLStdDev</th>
<th>Upper CLStdDev</th>
<th>StdErr</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.142</td>
<td>0.1487</td>
<td>0.1559</td>
<td>0.156</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0.0883</td>
<td>0.0942</td>
<td>0.1007</td>
<td>0.1008</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0.128</td>
<td>0.1329</td>
<td>0.1381</td>
<td>0.1382</td>
<td>0.0077</td>
<td></td>
</tr>
</tbody>
</table>

PROC PRINT of 'TTests' Output Data Set

<table>
<thead>
<tr>
<th>Obs</th>
<th>Variable</th>
<th>Method</th>
<th>Variances</th>
<th>tValue</th>
<th>DF</th>
<th>Probt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RecklessDriving</td>
<td>Pooled</td>
<td>Equal</td>
<td>1.77</td>
<td>1331</td>
<td>0.0763</td>
</tr>
<tr>
<td>2</td>
<td>RecklessDriving</td>
<td>Satterthwaite</td>
<td>Unequal</td>
<td>2.04</td>
<td>1267</td>
<td>0.0413</td>
</tr>
</tbody>
</table>

PROC PRINT of 'TEqual' Output Data Set

<table>
<thead>
<tr>
<th>Obs</th>
<th>Variable</th>
<th>Method</th>
<th>NUMDF</th>
<th>DenDF</th>
<th>FValue</th>
<th>ProbF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RecklessDriving</td>
<td>Folded F</td>
<td>884</td>
<td>447</td>
<td>2.49</td>
<td>&lt;.0001</td>
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</table>
OUTPUT #3: Contents of Merged Output Data Set

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<th>Obs</th>
<th>Variable</th>
<th>Class</th>
<th>Lower N</th>
<th>CLMean</th>
<th>Upper Mean</th>
<th>Lower CLStdDev</th>
<th>Upper CLStdDev</th>
<th>StdDev</th>
<th>Upper CLStdDev</th>
<th>StdErr</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RecklessDriving</td>
<td>ADAT</td>
<td>885</td>
<td>0.0128</td>
<td>0.0226</td>
<td>0.0324</td>
<td>0.1421</td>
<td>0.142</td>
<td>0.1487</td>
<td>0.1559</td>
<td>0.156</td>
</tr>
<tr>
<td>2</td>
<td>RecklessDriving</td>
<td>County</td>
<td>448</td>
<td>0.0002</td>
<td>0.0089</td>
<td>0.0177</td>
<td>0.0884</td>
<td>0.0883</td>
<td>0.0942</td>
<td>0.1007</td>
<td>0.1008</td>
</tr>
<tr>
<td>3</td>
<td>RecklessDriving</td>
<td>diff (1-2)</td>
<td>0</td>
<td>-0.001</td>
<td>0.0137</td>
<td>0.0288</td>
<td>0.128</td>
<td>0.128</td>
<td>0.1329</td>
<td>0.1381</td>
<td>0.1382</td>
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<table>
<thead>
<tr>
<th>Obs</th>
<th>Maximum</th>
<th>Method</th>
<th>Variances</th>
<th>tValue</th>
<th>DF</th>
<th>Prob</th>
<th>Method</th>
<th>NumDF</th>
<th>DenDF</th>
<th>FValue</th>
<th>ProbF</th>
<th>FMethod</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Folded F</td>
<td>Equal</td>
<td>1.77</td>
<td>1331</td>
<td>0.0763</td>
<td>Pooled</td>
<td>884</td>
<td>447</td>
<td>2.49</td>
<td>&lt;.0001</td>
<td>Folded F</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Satterthwaite</td>
<td>Unequal</td>
<td>2.04</td>
<td>1267</td>
<td>0.0413</td>
<td>Satterthwaite</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
## OUTPUT #4: Contents of Key Statistics Merged Into a Single Observation

**MWSUG 2003 Conference**  
**Macro Program for Displaying T-test Results - Brent Baxter**  
**PROC PRINT of Single Observation Containing T-test Results**

<table>
<thead>
<tr>
<th>Obs</th>
<th>Variable</th>
<th>Class</th>
<th>N</th>
<th>Lower CLMean</th>
<th>Mean</th>
<th>Upper CLMean</th>
<th>Lower CLStdDev</th>
<th>Upper CLStdDev</th>
<th>Stdev</th>
<th>UMPULower CLStdDev</th>
<th>UMPUUpper CLStdDev</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RecklessDriving</td>
<td>County</td>
<td>448</td>
<td>0.0002</td>
<td>0.0089</td>
<td>0.0177</td>
<td>0.0884</td>
<td>0.0883</td>
<td>0.0942</td>
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</table>

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<th>Variances</th>
<th>tValue</th>
<th>DF</th>
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<th>TMethod</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>0</td>
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<td>Satterthwaite</td>
<td>Unequal</td>
<td>2.04</td>
<td>1267</td>
<td>0.0413</td>
<td>Satterthwaite</td>
</tr>
</tbody>
</table>

<table>
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<tr>
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<th>NumDF</th>
<th>DenDF</th>
<th>FValue</th>
<th>ProbF</th>
<th>FMethod</th>
<th>ADATYes</th>
<th>Yes</th>
<th>ADATPercent</th>
<th>County Percent</th>
<th>TStat</th>
<th>Signif</th>
<th>ADATN</th>
<th>ADATSD</th>
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<tbody>
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<td>1</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>20</td>
<td>4</td>
<td>2.3</td>
<td>0.9</td>
<td>0.0413</td>
<td>885</td>
<td>0.14870</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obs</th>
<th>County</th>
<th>N</th>
<th>CountySD</th>
<th>GI N</th>
<th>GI Yes</th>
<th>GI Percent</th>
<th>County</th>
<th>SST</th>
<th>ViolationType</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>448</td>
<td>0.094174</td>
<td>885</td>
<td>20</td>
<td>2.25989</td>
<td>0.14870</td>
<td></td>
<td></td>
<td>Reckless Driving</td>
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</tbody>
</table>
#5: Output of Selected T-test Results Generated from Macro Call

MWSUG 2003 Conference  
Macro Program for Displaying T-test Results - Brent Baxter  
Selected Results from 'KeyStats' Output Data Set

<table>
<thead>
<tr>
<th>Violation Type</th>
<th>ADAT Yes</th>
<th>ADAT Percent</th>
<th>County Yes</th>
<th>County Percent</th>
<th>Stat Signif</th>
<th>Signif Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reckless Driving</td>
<td>20</td>
<td>2.3</td>
<td>4</td>
<td>0.9</td>
<td>0.0413</td>
<td>* p &lt; .05</td>
</tr>
</tbody>
</table>

* p < .05
### OUTPUT #6: Output of Selected T-test Results Generated from Repeated Macro Calls

MWSUG 2003 Conference  
Macro Program for Displaying T-test Results - Brent Baxter  
Summary of Results for Multiple T-tests

<table>
<thead>
<tr>
<th>Obs</th>
<th>Violation Type</th>
<th>ADATYes</th>
<th>ADATPercent</th>
<th>County Yes</th>
<th>County Percent</th>
<th>Stat Signif</th>
<th>Signif Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reckless Driving</td>
<td>20</td>
<td>2.3</td>
<td>4</td>
<td>0.9</td>
<td>0.0413</td>
<td>* p &lt; .05</td>
</tr>
<tr>
<td>2</td>
<td>Carpool Lane Violation</td>
<td>142</td>
<td>16.0</td>
<td>3</td>
<td>0.7</td>
<td>&lt;.0001</td>
<td>*** p &lt; .001</td>
</tr>
<tr>
<td>3</td>
<td>Crossing Physical Barrier</td>
<td>10</td>
<td>1.1</td>
<td>1</td>
<td>0.2</td>
<td>0.0309</td>
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</tr>
<tr>
<td>4</td>
<td>Disobey Traffic Control Device</td>
<td>7</td>
<td>0.8</td>
<td>21</td>
<td>4.7</td>
<td>0.0002</td>
<td>*** p &lt; .001</td>
</tr>
<tr>
<td>5</td>
<td>Failure to Stop</td>
<td>5</td>
<td>0.6</td>
<td>20</td>
<td>4.5</td>
<td>0.0001</td>
<td>*** p &lt; .001</td>
</tr>
<tr>
<td>6</td>
<td>Failure to Use Turn Signal</td>
<td>89</td>
<td>10.1</td>
<td>7</td>
<td>1.6</td>
<td>&lt;.0001</td>
<td>*** p &lt; .001</td>
</tr>
<tr>
<td>7</td>
<td>Following Too Closely</td>
<td>129</td>
<td>14.6</td>
<td>8</td>
<td>1.8</td>
<td>&lt;.0001</td>
<td>*** p &lt; .001</td>
</tr>
<tr>
<td>8</td>
<td>Illegal Entry Limited Access Hwy</td>
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<td>1.1</td>
<td>0</td>
<td>0.0</td>
<td>0.0015</td>
<td>** p &lt; .01</td>
</tr>
<tr>
<td>9</td>
<td>Lane Violation</td>
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<td>1.1</td>
<td>&lt;.0001</td>
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<tr>
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<td>Negligent Driving</td>
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</tr>
<tr>
<td>11</td>
<td>Passing Violation</td>
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<td>0.2241</td>
<td>NS</td>
</tr>
<tr>
<td>12</td>
<td>Speeding</td>
<td>564</td>
<td>63.7</td>
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