

# TABULATING THE RESULTS: AN APPLICATION OF SAS® SOFTWARE TO PERIODIC REPORTING IN A LONGITUDINAL EPIDEMIOLOGIC STUDY

William C. Murphy, Howard M. Proskin, and Dennis H. Leverett  
Eastman Dental Center

## Abstract

Reports consisting of dozens of similar tables are required for the periodic monitoring of an ongoing epidemiologic survey. Data gathered in the field are regularly assembled into the SAS system for study and analysis. PROC TABULATE, with its various options, is ideal for producing the tables needed for the periodic reporting of study results. The use of the extended ASCII character set on a PC allows the alteration of the FORMCHAR option in order to generate publication-quality tables on a laser printer. The use of formatting, and both LABEL and KEYLABEL statements, enables the further customization of tables. Furthermore, the use of the SAS macro language facilitates the automation of table production. Macros routines are also useful for generating indexes, and for providing date-stamps on the tables.

## Introduction

In a large-scale multifaceted longitudinal epidemiologic study, a database may be accumulated from a variety of input sources over a span of several years' time. The periodic interim reporting of results to date will often include an enumeration of what data has been incorporated thus far, as well as the preparation of numerous summary tables.

As an example of such a study, the authors are participating in a longitudinal investigation of the oral health of senior adults, (initially) aged 54 through 77. Study subjects are examined periodically to obtain dental, periodontal, and oral soft-tissue health assessments. A denture examination is also conducted, when necessary. Furthermore, a questionnaire on life style and general health is also administered. Each aspect of these exams is entered using separate case-report forms, and is entered into separate respective databases.

## Tables

The SAS system can readily be used to make tables from our datasets using PROC TABULATE. One of the first tables we wish to make involves checking what exam each subject received. To do this we write

```
proc tabulate;
class idno;
```

```
var t1 t2 t3 t4 t5 count;
table idno, (t1 t2 t3 t4 t5 count)*sum;
```

where the variables t1 t2 t3 t4 t5 are either 1 or 0. These variables were formed by merging the caries, denture, periodontal, soft tissue, and questionnaire exam datasets and noting the presents of the subject with an 'in' option for each dataset. Count is the sum of the 't' variables. Since there is only one entry for each identification number (idno), the sum function in PROC TABULATE gives the value of the 't' variables. The table resulting from this code is given in figure 1.

IDNO	T1	T2	T3	T4	T5	COUNT
	SUM	SUM	SUM	SUM	SUM	SUM
727	1.00	0.00	1.00	1.00	1.00	4.00
728	1.00	0.00	0.00	0.00	1.00	2.00
729	1.00	0.00	1.00	0.00	1.00	3.00
730	1.00	0.00	1.00	1.00	1.00	4.00
731	1.00	0.00	1.00	1.00	1.00	4.00
732	0.00	1.00	0.00	1.00	1.00	3.00
733	0.00	1.00	0.00	0.00	1.00	2.00
734	0.00	1.00	0.00	0.00	1.00	2.00
735	0.00	1.00	0.00	0.00	1.00	2.00
736	1.00	1.00	1.00	1.00	1.00	5.00
737	1.00	0.00	1.00	1.00	1.00	4.00
738	1.00	0.00	1.00	0.00	1.00	3.00
739	0.00	1.00	0.00	0.00	1.00	2.00
740	1.00	0.00	1.00	0.00	1.00	3.00
741	1.00	0.00	1.00	0.00	1.00	3.00
742	1.00	0.00	1.00	0.00	1.00	3.00
743	1.00	0.00	0.00	0.00	1.00	2.00

Figure 1. Table without enhancements.

Although this table contains all of the information that we need, it is obscure for those who are unfamiliar with the names and values of our variables, and the dashed lines of the frame are not aesthetically pleasing. Furthermore, the label 'SUM' is unnecessary and a total number in each exam group would be useful. Fortunately,



## Many Tables

The check-off list generated above is only one of many tables that must be reproduced. The techniques used in the tables are essentially identical with those given above. However, the summaries that we wish to prepare are stratified by sex and age of the subjects. Since most of the tables are of the same form we can write one table statement and include it in a macro loop.

The subtitles will now change, table numbers will be introduced, and the date given in the footnote must reflect the time the table was created, since tables will be prepared periodically. We can create an ASCII file with the 4 lines of information for each table (blank lines if we don't use all 4) along with a blank line separator, and then read these strings into SAS macros:

```
data _null_;
infile 'c:\work\titles' missover eof=last;
input tno $11
      #2 ta $63.
      #3 tb $65.
      #4 sasvar $8.;
call symput("&tln"|left(_n),trim(tno));
call symput("&tla"|left(_n),trim(ta));
call symput("&tlb"|left(_n),trim(tb));
call symput("&var"|left(_n),sasvar);
return;
last: call symput("&tally",_n_-1);
return;
```

After running this, our first table number will be stored in &tln1; the first line of the subtitle for the first table in &tla1; the second line of the subtitle for the first table in &tla1; and the first variable to be include in the table will be contained in &var1. The first two lines of the title are globally used and defined in the calling program. The total number of tables will be contained in the macro variable &tally. The information for the second table will be in the macros variables &tln2, &tla2, &tla2, &var2, and so on. To include these in our tables, we write the header macro routine:

```
%macro head(n);
title3 "&tln&n";
title4 ;
title5 "&tla&n";
title6 "&tla&n";
%mend head;
```

To accurately date our tables we can use the macro variable &sysdate formatted into the global macro variable &fdate (SAS Guide to Macro Processing, 6th ed, p. 204). This is used in a footnote statement in our main program:

```
footnote "Database Current as of &fdate";
```

Finally we can write our macro routine for creating tables:

```
%macro tab;
%do i=1 %to &tally;
```

```
proc tabulate
data=one(keep=sex age &&var&i);
%head(&i);
class sex age;
var &&var&i;
table age=" all='All Ages',
      (sex=" all='Both Sexes')*
      (&&var&i=")*
      (n*f=4, mean='Mean'*f=6.2 std*f=5.2)
      /box=' Age' rts=10;
run;
%end;
%mend tab;
```

To save time and memory, we have restricted our input data to contain only the variables needed. (We also should note that another macro routine is used in our reporting in which 'pctn' replaces the keywords 'mean' and 'std' for use with categorical variables.) A sample output from this routine is given in Figure 3.

Eastman Dental Center Adult Oral Health Survey Table 5.3 Mean Number of Teeth for Dentate Subjects by Age Group and Sex									
Age	Male			Female			Both Sexes		
	N	Mean	STD	N	Mean	STD	N	Mean	STD
54-56	9	24.33	3.20	29	21.76	6.56	38	22.37	6.00
57-59	17	21.65	6.48	29	21.72	5.48	46	21.70	5.80
60-62	22	19.27	6.00	52	21.67	5.62	74	20.96	5.80
63-65	36	22.17	5.61	51	20.82	6.77	87	21.36	6.32
66-68	46	20.65	6.16	82	20.27	6.74	128	20.41	6.52
69-71	58	19.76	5.97	106	18.82	6.80	164	19.15	6.52
72-74	45	17.19	7.60	98	18.29	6.52	143	17.93	6.87
75-77	37	17.51	6.90	54	18.06	7.92	91	17.84	7.48
ALL Ages	270	19.73	6.57	501	19.71	6.77	771	19.71	6.69

Database Current as of March 10, 1992

Figure 3. Table generated with macro routine.

## Conclusions

We see that the SAS system using PROC TABULATE can be readily used to create publication quality tables on a graphics printer. Using options, labels, and formats, we have a great deal of control over the final product. Using macro programming, we are able to readily automate the preparation of a large number of similar tables for periodic reports.

## For Additional Information Contact

William C. Murphy  
Eastman Dental Center  
625 Elmwood Ave.  
Rochester, NY 14620  
(716)-275-8296

## **Acknowledgements**

Support provided by NIH NIDR grant R01 DE09109;  
D. H. Leverett, Principal Investigator.

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