

## TADPOLE: An Application for Evaluation of the State of Tennessee's Alcohol and Drug Prevention Program Using the SAS® System

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### ABSTRACT

Tennessee Alcohol and Drug Prevention Outcome Longitudinal Evaluation (TADPOLE) is a system which annually evaluates the outcomes of state-funded alcohol and drug prevention programs in Tennessee. At risk adolescents are evaluated before and after participation in drug and alcohol prevention programs statewide with the data sent to a central location for analysis. The SAS system is used throughout this evaluation process from data cleaning and matching, to growth curve modeling, scaling, and the final analysis.

This paper illustrates the flexibility and robustness of the SAS system as an applications tool. The programs utilized are not operating system specific and have been run on the Windows, VMS and UNIX platforms. SAS Base, SAS/FSP and SAS/STAT are used in this application.

### INTRODUCTION

TADPOLE was jointly developed by the Tennessee Department of Health, Bureau of Alcohol and Drug Abuse Services, the Early Intervention Task Force and the Department of Anthropology at the University of Memphis and is an ongoing project. Implementation of this project began July 1, 1992.

Primary prevention programs aimed at reducing alcohol and drug abuse were offered to "higher than average" risk youths aged 10 to 18 or grades 5 to 12. Over 255 separate schools and programs participate throughout the state. Students are included in this program if they meet one of the following criteria:

- Past usage by the student
- Parent or sibling with use or abuse history
- Student is victim of physical or sexual abuse or has witnessed domestic violence
- Peer group uses alcohol or drugs
- Student exhibits pattern of discipline problems at school, home, or in the community

All identified "at risk" youths become part of the prevention program. The Student Attitudinal Survey (SAI) developed by Dr. Sehwan Kim is used for the program evaluation. This instrument consists of 72 items, all based on a Likert-type scale and 6 identification/demographic items. The questionnaire is designed to be completed in 30 to 40 minutes by the students. The questions are designed to measure five attitudinal scales: drug attitude, school value, self-esteem, social attitude, and rebelliousness. In addition gateway drug use, hard drug use, and smoking patterns are measured through self reporting.

These students are administered pretests, posttests, and follow-ups. Administrators receive training each fall before the pretest administration. The instrument is administered in a classroom environment. Answers are entered by the students directly on bubble sheets which are then sent to the University of Memphis for processing. To promote confidentiality of responses no identification number or name is used on the questionnaire.

In 1995, a separate prevention program was developed for latch-key youth in urban areas of the state. The identical evaluation instrument is being used on a trial basis in this program.

SAS programs used in the application are generic and have been run with SAS/Windows, VMS and UNIX. Current versions here at the University of Memphis are SAS/Windows 6.11, SAS 6.08 for VMS and SAS 6.09 for UNIX. The UNIX operating system is on a Sun SPARCclassic running Solaris 2.

### DATA ENTRY/VALIDATION

As in any prevention program, the analysis can only be as accurate as the data that it relies upon. Once the data has been scanned and entered into a data file, the first processing identifies missing critical data and data that is out of range for the variable.

Data arrives on the scan forms in separate mailings from each prevention program across the state. As each set of data is received and scanned into a file, missing program numbers, test types and dates of test are filled in manually, using the information provided by the program.

The following SAS program is used to identify invalid or missing data for these variables. The line numbers in the ASCII data set are output to assist in the data correction process.

```

libname s ' ';
data tad1;
infile tad9495 missover;
input mm1 41-42 dd1 43-44 yy1 45-46 program 47-49 testno 50
      @51 (q1-q10) (1.) @101 (q11-q38) (1.) @241 (q39-q50) (1.)
      @301 sex $1. mm2 302-303 dd2 304-305 yy2 306-307 @308
      grade 2. @310 (race1-race5) (1.) @330 (q57-q78) (1.);
%include progname;
if mm1 lt 1 or mm1 gt 12 then mm1=.;
if yy1 lt 94 or yy1 gt 95 then yy1=.;
if mm2 lt 1 or mm2 gt 12 then mm2=.;
if yy2 lt 70 or yy2 gt 89 then yy2=.;
if mm1 gt mm2 then months=((yy1-yy2)*12)+(mm1-mm2);
  else if mm1 le mm2 then months=((yy1-yy2)*12)-(mm2-mm1);
date=mdy(mm1,dd1,yy1);
dob=mdy(mm2,dd2,yy2);
nobs=_n_;
if grade ge 5;
data s.pretest(compress=yes) s.posttest(compress=yes)
  s.followup(compress=yes) out; set new;
if program ne . and date ne . and testno ne . then do;
  if testno=0 then output s.pretest; else if testno=1 then output
  s.posttest; else if testno=2 then output s.followup; end;
else do; output out;
run;
proc print data=out;
var nobs program testno dd1 mm1 yy1 dd2 mm2 yy2 testno;
run;

```

The focus then shifts to the variables that are used for matching between pretests and posttests and between pretests and follow-ups: date of birth, sex, grade, and race. Those that have no missing information are matched, and those that do not match are output to a file for hand matching. Hand matching consists of everything from recording information that was written properly on the forms and not bubbled properly to actual handwriting comparisons.

It is imperative to match as many pretests to posttests as possible since funding each year is tied to participation in the program. On the other hand, the students must be "real matches" rather than "contrived", or the data has no meaning. This process is the most time consuming in the entire application. The following SAS program is used to identify matched pairs and output those unmatched items to be used in hand matching:

```
libname s 'J';
data one; set s.pretest;
data two; set s.posttest(rename=(nobs=nobs2 dob=dob2
  grade=grade2 sex=sex2 program=program2 race1=prace1
  race2=prace2 race3=prace3 race4=prace4 race5=prace5
  dd2=pdd2 mm2=pmm2 yy2=pyy2));
proc sql; create table three as select * from s.pretest as one full join
s.posttest as two where one.dob=two.dob2 and one.grade =
two.grade2 and one.sex=two.sex2 and
one.race1=two.prace1 and one.race2=two.prace2 and
one.race3=two.prace3 and one.race4=two.prace4 and
one.race5=two.prace5 and one.program=
two.program2 order by program;
proc print data=three;
var nobs mm2 dd2 yy2 grade sex race1-race5;
where nobs2=.;
by program;
proc print data=three;
var nobs2 pmm2 pdd2 pyy2 grade2 sex2 prace1-prace5;
where nobs=.;
by program;
run;
data s.three(compress=yes);
set three(drop=dob2 grade2 sex2 program2 prace1 prace2
prace3 prace4 prace5 pmm2 pdd2 pyy2);
run;
```

Unfortunately matched rates are not as high as we would like. In the past year out of 1800 posttests, about 1200 were actually matched through this process, with about 900 matching without hand matching.

## DATA ANALYSIS

Data analysis begins by growth curve modeling. Because attitudes as identified by these scales automatically go down as age increases, a model must be developed to identify the per month changes for each of these attitude scales. For each scale a separate factor is computed that represents the normal per month decline in attitude for each scale. This is done using all of the pretests as a control group. Because one hundred percent of the at risk population participates in the program there can be no outside control group; therefore attitudes of the participants before administration of the program is substituted.

Other factors are also run through the program to see if they impact the differences in attitudes, but no factor other than age has been found to be significant.

If an individual leaves a question or questions blank that is/are used in the calculation of the scale scores used to compute these attitudes, the mean of the other questions used to compute the

score is substituted for the missing question or questions. Questions are recoded so that responses to negative questions match the direction of responses to positive questions.

The following program illustrates this growth curve modeling for one scale, the drug attitude scale:

```
libname s 'J';
data model;
set s.pretest;
if months=. then do;
months=intck('month',dob,date); end;
array qi(*)
Q1 Q15 Q21 Q26 Q30-Q32 Q41 Q45 Q49;
do i = 1 to dim(qi);
if qi(i)=1 then qi(i)=5;
else if qi(i)=2 then qi(i)=4;
else if qi(i)=4 then qi(i)=2; else if qi(i)=5 then qi(i)=1;
else qi(i)=.;
end; drop i;
mdat1=mean(Q1,Q5,Q11,Q16,Q21,Q26,Q31,Q36,Q41,Q44);
array dat(*) Q1 Q5 Q11 Q16 Q21 Q26 Q31 Q36 Q41 Q44;
do i = 1 to dim(dat);
if dat(i)=. then dat(i)=mdat1
end; drop i;
dat1=(sum(Q1,Q5,Q11,Q16,Q21,Q26,Q31,Q36,Q41,Q44)-10)*2.5;
if dat=0 then dat=.;
if month(dob) gt month(date) then
proc glm data=model;
model dat1=months;
run;
```

The rate of change for each attitude scale with respect to the age in months is then entered into the program to correct for any natural attitudinal decline with age identified with the general linear model.

Any subjects that had perfect scores or zeros on the pretest are then eliminated from the analysis. After eliminating perfect scores, the top and bottom 2.5 percent (extremes) are also eliminated from the analysis, as per the methodology of Dr. Kim when developing this instrument. Paired t-tests are then run to identify differences in attitudes between the pretests and the posttests.

The following program illustrates this for the drug attitude scale. In this instance the observations used are hardcoded using the `_n_` automatic variable. In practice, a macro is used to compute these numbers and include the values during the program.

```
libname s 'J';
data one;
set s.three;
if sum(dat1+soa1+est1+val1+reb1) ge 475 then delete;
dmonth=intck('month', date2, date);
dat=(dat2-dat1)+(.2073*dmonth);
proc sort data=one out=dat; by dat;
data dat; set dat;
if _n_ le 27 or _n_ ge 1054 then delete;
proc means maxdec=2 data=dat n mean stderr t prt noprint;
var dat1 dat2;
output out=dat2 n=n mean=mean datm1 datm2
stderr=stderr t=t prt=probt;
data dat; length var $ 30;
set dat2;
scale='Drug Attitude Scale Score'; att=1;
proc print noobs i;
var scale n pretest posttest mean stderr t probt;
label var='Scale' mean='Mean Difference';
title1 'TADPOLE PAIRED-COMPARISONS T-TEST';
title2 'PreTest vs. PostTest';
run;
```

In addition to changes between the pretest and posttest, changes are also computed between the pretest and a follow-up given a few months after the posttest. These changes in attitude are not only computed for the overall differences, but are computed separately for each agency participating in the state's drug and alcohol prevention program, for each region, and for demographic factors such as ethnicity and gender. Drug use information, by category, is also reported. The demographics of the database as a whole are also computed.

The report computed for the state includes the following:

- I. Introduction
- II. Demographics
  - A. State
    - Ethnicity, Gender and Age
    - Ethnicity, Gender and Grade
  - B. Primary Prevention Program
    - Age
    - Ethnicity, Gender, and Age
    - Ethnicity, Gender, and Grade
    - Risk Factors
    - Type of Program
    - Drug Use
  - C. Demographics, Attitudes, and Behaviors
    - Ethnicity, Gender, Age, and Attitudes
    - Ethnicity, Gender, Age and Drug Use
- III. Attitudes and Drug Use Behaviors
  - A. How to Interpret the Attitude Scales
  - B. List of Items which Comprise the Attitude Scales
  - C. Pre-Post Changes in Attitudes and Behaviors
  - D. Pre-Follow-up Changes in Attitudes and Behaviors
  - E. Comparisons of Attitudes and Behaviors with Prior Year
- IV. Satisfaction
  - A. Student Satisfaction
  - B. Parent Satisfaction
  - C. Referral Source Satisfaction

In addition, each agency receives an individual report. An example of an agency report follows:

Agency Name  
Tennessee Alcohol and Drug Outcomes Longitudinal Evaluation  
(TADPOLE)  
1995

This report presents evaluation results of the Primary Prevention Programs.

**Satisfaction Results:**

Satisfaction was measured on a scale from 1 to 5 with 5 being the highest level of satisfaction.

**Student Satisfaction:**

Agency average student satisfaction = na  
State average student satisfaction = 4.08  
State range = 2.71 to 4.64

**Parent Satisfaction:**

Number of parents participating = na  
Agency average parent satisfaction = na  
State average parent satisfaction = 4.03  
State range = 3.36 to 4.52

**Outcome Results:  
Student Attitudes**

	AGENCY			STATE		
	Mean Post	Mean Pre	Diff	Mean Post	Mean Pre	Diff
Self Esteem	66.0	56.3	9.2*	62.97	59.59	3.41*
Drug Attitudes	74.3	70.3	4.0	74.87	75.19	0.39
Non-Rebellious	56.9	52.9	6.0	55.09	52.29	2.89*
School Value	77.4	71.3	6.0	76.08	74.79	1.3*
Social Attitude	80.0	69.1	12.6*	75.55	73.8	1.7*

\*Indicates a statistically significant difference between pre and post test scores.  
Student Behavior

	AGENCY			STATE		
	Mean Post	Mean Pre	Diff	Mean Post	Mean Pre	Diff
Gateway Drugs	10.4	16.3	-6.0*	8.7	11.4	-2.7*
Smokeless Tobacco	.7	10.0	-9.3 *	4.3	6.4	-2.1*
Hard Drugs	1.2	3.4	-2.2	.3	1.2	-.9*

\*Indicates a statistically significant difference between pre and post test scores.

In the above report, a positive difference in attitude indicates a more positive attitude, corrected for age. A negative difference in drug use, indicates a decline in drug use. Alcohol is included as a drug in the attitude scales and is also included in the gateway drug use scale.

A similar evaluation is provided for the State of Tennessee's alcohol and drug treatment program.

**CONCLUSION**

The SAS System is used extensively in the State of Tennessee's evaluation of the effectiveness of its drug and alcohol prevention programs. Ongoing research includes analysis of individual scale items and their effects on the scales, inclusion of the extremes, and possible development of a new, locally created instrument. The SAS system is used for all phases of this project.

**REFERENCES**

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