Using Macro in SAS® to Calculate Kappa and 95% CI for Several Pairs of Nurses of Chemical Triage
ABSTRACT

It is often necessary to assess multi-rater agreement for multiple observation categories in case controlled studies. The Kappa statistic is one of the most common agreement measures for categorical data. This paper used data from the Validating Triage for Chemical Mass Casualty Incidents – A First Step RO1 grant to assess the performance of a typical hospital triage system called the Emergency Severity Index (ESI). The Kappa statistic calculates the percentage of agreement among two or more raters after removing the percentage of agreement which would occur by chance. The SAS® PROC FREQ procedure supports the application of the Kappa statistic for two raters and several categories.

RESULTS

Table 1 indicate very poor agreement for nurse 5 and 12 (simple kappa=.07 with 95% CI -.04 to .17 and weighted kappa =.20 with 95% CI of .10 to .30). However, the result excellent agreement for nurses 20 and 23 (simple kappa=.79 with 95% CI .68 to .90 and weighted kappa =.89 with 95% CI of .81 to .97).

CONCLUSION

This paper provides an example of how to use macro to calculate percentage agreement with the Kappa statistic with 95% CI using SAS® PROC FREQ, MEANS, and PRINT when we have several pairs of raters. This paper expands the current functionality of the SAS® PROC FREQ procedure to support the application of the Kappa statistic using macro to reduce length syntax in program.

INTRODUCTION

It is often necessary to assess multi-rater agreement for multiple observation categories in case controlled studies. The Kappa statistic is one of the most common agreement measures for categorical data. The Kappa statistic calculates the percentage of agreement among two or more raters after removing the percentage of agreement which would occur by chance. The SAS® PROC FREQ procedure supports the application of the Kappa statistic for two raters and several categories.

PURPOSE

The purpose of this paper is to show an approach for using the SAS® 9.4² procedures, including Macro language, to estimate Kappa with 95% CI for several pairs of nurses that used two hospital triage systems during a computer simulated chemical mass casualty incident.

METHODOLOGY

This paper used data from the Validating Triage for Chemical Mass Casualty Incidents – A First Step RO1 grant. The data included 147 victims of a chlorine disaster and 150 patients that were not exposed to the chlorine disaster. All patients were treated at the same medical facility.

PROC FREQ, TRANSPOSE, and PRINT were used to estimate Kappa and simple / weighted confidence interval. The study included many pairs of nurses to conduct the experiment.
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**SAS SYNTAX**

```sas
**** create macro to run for different pairs of nurses for ESI ***;
%macro process (d,n1,n2);
data &d ; set two;
if enid = &n1 or enid= &n2;run;
proc sort data=&d ; by epid;run;
**** here to create several column for each record using transpose procedure for each pair of nurse ***;
proc freq data=&d noprint;
tables Epid / out=ef&n1&n2 ; run;
proc sort data= ef&n1&n2 ; by epid ;run;
data en&n1&n2;
merge &d ef&n1&n2 ;
by epid ; run;
proc sort data=en&n1&n2 ; by epid ;run;
data ben&n1&n2 ; set en&n1&n2 ;
if count=2;run;
proc sort data=ben&n1&n2 ; by epid ;run;
PROC TRANSPOSE DATA=ben&n1&n2 OUT=wen&n1&n2 (DROP=_NAME_ _LABEL_) PREFIX=elevel ; BY epid ;
VAR esi_calclevel;RUN;
```

**SAS SYNTAX (Continue)**

```sas
proc sort data=wen&n1&n2; by epid;run;
%mend process; run;
%process (four, 5,12); run;
ods rtf;
ods listing close;
%macro print (d,t);
proc print data=&d;
var epid elevel1 elevel2  ;
title ' printing data / nurse ' &t;    run;
%mend print; run;
%print (wen512, 5 and 12); run;
%macro agree (d, t);
proc freq data=&d;
tables elevel1*elevel2 / agree ;
test AGREE; exact agree/mc n=10000 alpha=.05;
title ' frequency tables / Kappa Agreement/' &t;    run;
%mend agree; run;
%agree (wen512, 5 and 12); run;
ods rtf close; ods listing;quit;run;
```

**ACKNOWLEDGEMENTS/CONTACT**

This study was funded by the National Library of Medicine: 1R01LM011648
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