SAS® GLOBAL FORUM 2017

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

USERS PROGRAM

EPOSTERBOARDS TEMPLATE

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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 R01 grant to assess the performance of a typical hospital triage system called the Emergency Severity Index (ESI)[14] compared with an Irritant Gas Syndrome Agent Syndrome (IGSA) Triage Algorithm, being developed from this grant, to quickly prioritize the treatment of victims of IGSA incidents. Six different pairs of nurses used ESI triage and seven pairs of nurses used the IGSA Triage prototype to assess 25 patients exposed to an IGSA and 25 patients not exposed. The results indicated 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).

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[1]. 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 ®[2] PROC FREQ procedure supports 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® 9.4[2] 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.

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).

Table 2 indicate 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).

Figure 1 indicates the plot of Kappa agreement for ESI with nurses 5 and 12. The result indicates very poor agreement for each level by nurse 5 and 12.

Figure 2 shows the plot of Kappa agreement for IGSA with nurses 20 and 23. The result indicates excellent agreement for urgent, monitor, and no exposure by nurses 20 and 23.

Table 1: Simple and weighted Kappa with 95% CI for ESI nurse 5 and 12.

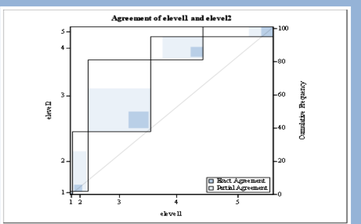
Simple Kappa Coefficient	
Kappa	0.0662
ASE	0.0529
95% Lower Conf Limit	-0.0374
95% Upper Conf Limit	0.1699

Test of H0: Kappa = 0	
ASE under H0	0.0459
Z	1.4414
One-sided Pr > Z	0.0747
Two-sided Pr > |Z|	0.1495

Weighted Kappa Coefficient	
Weighted Kappa	0.1963
ASE	0.0504
95% Lower Conf Limit	0.0976
95% Upper Conf Limit	0.2950

Test of H0: Weighted Kappa = 0	
ASE under H0	0.0447
Z	4.3925
One-sided Pr > Z	<.0001
Two-sided Pr > |Z|	<.0001

Figure 1: Plot of Kappa agreement for ESI with nurse 5 and 12.



Note: elevel1= nurse 5 and elevel2 = nurse 12

Table 2: Simple and weighted Kappa with 95% CI for IGSA nurse 20 and 23.

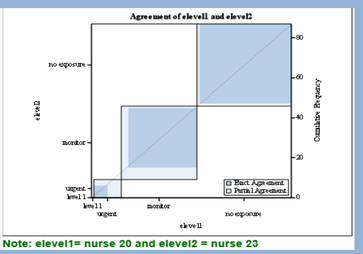
Simple Kappa Coefficient	
Kappa	0.7901
ASE	0.0559
95% Lower Conf Limit	0.6806
95% Upper Conf Limit	0.8996

Test of H0: Kappa = 0	
ASE under H0	0.0822
Z	9.6120
One-sided Pr > Z	<.0001
Two-sided Pr > |Z|	<.0001

Weighted Kappa Coefficient	
Weighted Kappa	0.8870
ASE	0.0407
95% Lower Conf Limit	0.8073
95% Upper Conf Limit	0.9667

Test of H0: Weighted Kappa = 0	
ASE under H0	0.0954
Z	9.2991
One-sided Pr > Z	<.0001
Two-sided Pr > |Z|	<.0001

Figure 2: Plot of Kappa agreement for IGSA with nurse 20 and 23.



Note: elevel1= nurse 20 and elevel2 = nurse 23

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 application of the Kappa statistic using macro to reduce length syntax in program.

EPOSTERBOARDS TEMPLATE

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SAS SYNTAX

```
**** 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)

```
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;
```

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