Using SAS® to Estimate SE, SP, PPV, NPV, and Other Statistics of Chemical Mass Casualty Triage
ABSTRACT

Chemical incidents involving irritant chemicals such as chlorine pose a significant threat to life and require rapid assessment. This paper used data from the Validating Triage for Chemical Mass Casualty Incidents – A First Step R01 grant to determine the most predictive signs and symptoms (S/S) for a chlorine mass casualty incident. SAS® 9.4 was used to estimate sensitivity, specificity, positive and negative predictive values, and other statistics of irritant gas syndrome agent S/S for two exiting disasters designed to assist emergency responders in hazardous material incidents (Wireless Information System for Emergency Responders [WISER] and CHEMM Intelligent Syndromes Tool [CHEMM-IST]). The result for WISER showed the sensitivity was .72 to 1.0; specificity .25 to .47; and the positive predictive value and negative predictive value were .04 to .87, and .33 to 1.0, respectively. The results for CHEMM-IST showed the sensitivity was .84 to .97; specificity .29 to .45; and the positive predictive value and negative predictive value were .18 to .42, and .86 to .97, respectively.

INTRODUCTION

Disasters happen in the world every day. Disasters can be categorized into two categories: natural and unnatural. One of the greatest challenges is effective disaster response to all hazards events. Chemical incidents involving irritant chemicals such as chlorine pose a significant threat to life and require rapid assessment and triage. None of the current hospital-based triage systems are effective in establishing a triage priority for victims exposed to chlorine, an irritant gas syndrome agent.

PURPOSE

This paper used the SAS® 9.4 procedure to estimate sensitivity, specificity, positive and negative predictive values, and other statistics to determine the most predictive signs and symptoms (S/S) for two exiting systems designed to assist emergency responders in hazardous material incidents (WISER and CHEMMIST).

METHODODOLOGY

This paper used data from the Validating Triage for Chemical Mass Casualty Incidents – A First Step R01 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 was used to estimate sensitivity, specificity, positive and negative predictive values, and other statistics with the 95% confidence interval and test both asymptotic and exact. The option BINOMIAL used in the exact statement provided all of the exact tests of the proportion. Macro was used to reduce coding.

RESULTS

Table 1 showed the sensitivity was from .72 to 1.0. The specificity was from .25 to .47. The positive predictive value and negative predictive value were from .04 to .87, and .33 to 1.0, respectively. Table 2 showed the sensitivity was from .84 to .97. The specificity was from .29 to .45. The positive predictive value and negative predictive value were from .18 to .42, and .86 to .97, respectively. Table 3 showed the false positive probability was from .53 to .89. The false negative probability was from .06 to .28. Table 4 showed the false positive probability was from .55 to .71. The false negative probability was from .03 to .08.
**SAS Syntax**

*** Calculate Sensitivity **

```sas
ods rtf; ods listing close;
%macro se (q);
proc freq data=three order=formatted; where &q =1;
tables dei_chlorineexposure / binomial(level="A-Yes"); exact binomial;
title 'Sensitivity/ exposure as test/variables as response' &q; run;
%mend se;
%se (r01_WISER_mouth_coughchk ); run;
ods rtf close; ods listing; quit; run;
```

*** Calculate Specificity **

```sas
ods rtf; ods listing close;
%macro sp (q);
proc freq data=three order=formatted; where &q =0;
tables dei_chlorineexposure / binomial(level="B-No"); exact binomial;
title 'Specificity/ exposure as test/variables as response' &q; run;
%mend sp;
%sp (r01_WISER_mouth_coughchk ); run;
ods rtf close; ods listing; quit; run;
```

*** Calculate Positive Predictive Value **

```sas
ods rtf; ods listing close;
%macro PPV(q);
proc freq data=three order=formatted; where dei_chlorineexposure =1;
tables &q / binomial(level="A-Yes"); exact binomial; title 'PPV/exposure as test/variables as response' &q; run;
%mend PPV;
%ppv(r01_WISER_mouth_coughchk ); Run; ods rtf close; ods listing; quit; run;
```

*** Calculate Negative Predictive Value **

```sas
ods rtf; ods listing close;
%macro NPV(q);
proc freq data=three order=formatted; where dei_chlorineexposure =0;
tables &q / binomial(level="B-No"); exact binomial;
title 'NPV/exposure as test/variables as response' &q; run;
%mend NPV;
%npv(r01_WISER_mouth_coughchk ); Run; ods rtf close; ods listing; quit; run;
```

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