

THE USE OF PROC ARIMA TO TEST AN INTERVENTION EFFECT

Neil S. Fleming, Ph.D.
Sr. Vice-President
2W Systems Co., Inc.
5430 Alpha Rd., Suite. 305
Dallas, TX 75240 (214) 733-0588

In April 1992, the American Academy of Pediatrics (AAP) recommended that health infants be put to sleep on their side or back to reduce the risk of Sudden Infant Death Syndrome (SIDS). While a number of opinions exist on the efficacy of this recommendation, no statistical analysis heretofore had examined any subsequent changes in SIDS rates. However, Gibson and Fleming, et al. (1995) tested changes in SIDS rates for white and non-white populations in two major metropolitan areas using the Box and Tiao time-series intervention model.

This paper presents the SAS programming code for both the Data Step and statistical PROC along with the model estimated, including output statistics from SAS' Proc ARIMA to test before and after SIDS rates by quarter. Rates are normalized by the annual birth rate for the non-white population in one of the cities to mitigate changes due to births. The Data Step is presented to prepare 32 quarters of SIDS data to compare rates prior to the first half of 1992 versus subsequent quarters through 1994.

The model itself is examined using PROC ARIMA to test 1) the intervention effect subsequent to the AAP recommendations; 2) the seasonality effect, i.e., the increase during the winter quarter for the first three months of the year; and 3) the autoregressive/moving average components of the error structure.

Discussion of the results includes interpretation and testing of the model parameters in relation to their standard errors. Since the model is analyzed in terms of the natural logarithm of the SIDS rates, results are interpreted through percentage changes emanating from the intervention and seasonality. This examination demonstrates how time-series intervention analysis can be used to contribute to epidemiological research.

SAS PROGRAM CODE. NOTE THAT DATA HAVE BEEN REPLACED BY 'X' BECAUSE PUBLICATION IS PENDING FOR THIS RESEARCH.

```
DATA RESID.SIDS;
INPUT DATE WHITE NONWHITE;
INFORMAT DATE YYQ4.;
IF DATE GT '30JUN92'D THEN INTER=1; ELSE INTER=0;
IF WHITE=0 THEN LWHITE=0; ELSE LWHITE=LOG(WHITE);
LNONWHIT=LOG(NONWHITE);
IF QTR(DATE)=1 THEN SEASON=1; ELSE SEASON=0;
IF YEAR(DATE)=1987 THEN WBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1988 THEN WBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1989 THEN WBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1990 THEN WBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1991 THEN WBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1992 THEN WBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1993 THEN WBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1994 THEN WBIRTH=XXXXX;
IF WHITE=0 THEN LWRATIO=LOG(1/WBIRTH*10000);
ELSE LWRATIO=LOG(WHITE/WBIRTH*10000);
IF YEAR(DATE)=1987 THEN NBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1988 THEN NBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1989 THEN NBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1990 THEN NBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1991 THEN NBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1992 THEN NBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1993 THEN NBIRTH=XXXXX;
ELSE IF YEAR(DATE)=1994 THEN NBIRTH=XXXXX;
IF NONWHITE=0 THEN LBRATIO=LOG(1/NBIRTH*10000);
ELSE LBRATIO=LOG(NONWHITE/NBIRTH*10000);
CARDS;
87Q1      X XX
87Q2      X XX
87Q3      X XX
87Q4      X XX
88Q1      X XX
88Q2      X XX
88Q3      X XX
88Q4      X XX
89Q1      X XX
89Q2      X XX
89Q3      X XX
89Q4      X XX
90Q1      X XX
90Q2      X XX
90Q3      X XX
90Q4      X XX
91Q1      X XX
91Q2      X XX
91Q3      X XX
91Q4      X XX
92Q1      X XX
92Q2      X XX
92Q3      X XX
```

92Q4	X XX
93Q1	X XX
93Q2	X XX
93Q3	X XX
93Q4	X XX
94Q1	X XX
94Q2	X XX
94Q3	X XX
94Q4	X XX

RUN;

```

OPTIONS PAGENO=1;
%LET DEPVAR=LBRATIO;
PROC ARIMA DATA=RESID.SIDS;
IDENTIFY VAR=&DEPVAR(0) CROSSCOR=(INTER(0) SEASON(0)) NLAG=4 NOPRINT;
ESTIMATE INPUT=(INTER SEASON) ML;
TITLE1 "ANALYSIS OF LBRATIO FOR LOG OF NON-WHITE DEATHS PER 10,000";
TITLE2 "ANALYSIS WITHOUT ANY AR/MA TERMS";

```

```

PROC ARIMA DATA=RESID.SIDS;
IDENTIFY VAR=&DEPVAR(0) CROSSCOR=(INTER(0) SEASON(0)) NLAG=4 NOPRINT;
ESTIMATE Q=(3) INPUT=(INTER SEASON) ML;
TITLE2 "ANALYSIS WITH AR/MA TERMS";
RUN;

```