

Creating Birth Data Quality Reports: Identifying hospitals that submit high volumes of invalid data using PROC REPORT and ODS

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ABSTRACT

The quality and completeness of birth certificate data is essential to public health research, planning and services. State and Federal Maternal and Child health programs utilize birth certificate data to target mothers from particular racial/ethnic and age groups with low utilization of prenatal care or to investigate maternal characteristics associated with low birth weight, prematurity, infant mortality and other unfavorable birth outcomes.

Every year, the CDC-National Center for Health Statistics (NCHS) sets up standards of acceptable proportions of invalid data fields reported as not classifiable (i.e., outside predetermined ranges), unknown or blank in birth certificate data. Since the vast majority of birth certificates are collected and submitted by hospitals, the Center for Health Statistics at the Arkansas Department of Health needed a report that can easily identify fields with high proportions of invalid data by hospital of birth. Such a report is important for administrators of vital records and field representatives who can contact these hospitals to provide educational seminars to nurses and clerks on appropriate methods in collecting and reporting birth data.

This paper describes a SAS® program that can be used on any arbitrary set of birth data to provide a quick data quality tool. The project uses several features in the SAS programming language such as IF-THEN-ELSE statements, the SUMMARY procedure and ARRAY statements, but will mainly focus on the use of PROC FORMAT and PROC REPORT to color-code values of variables based on a decision rule¹ (i.e., exceed NCHS acceptable standard of invalid data) using the Output Delivery System (ODS).

INTRODUCTION

Arkansas State laws require birth certificates to be completed for all births, and Federal law mandates national collection and publication of births and other vital statistics data². The National Vital Statistics System (NVSS), the Federal compilation of this data, is the result of the cooperation between NCHS and State agencies to provide access to valuable statistical information from birth certificates.

With the introduction of ODS, we thought of taking advantage of its strong reporting capabilities and the ability to create appealing tables, to craft a report

¹ A similar approach is described by Karp (2003)

² National center for Health Statistics (NCHS)

that can be used to identify hospitals that contribute to high quantities of invalid data.

DESCRIPTION OF THE PROJECT

Using birth data submitted by 54 states and territories, NCHS, every year, generates a “NATALITY NOT CLASSIFIABLE AND UNKNOWN DATA REPORT” and makes it available to Centers for Health Statistics and Vital Records or any other individual state agencies that collect, edit and publish vital statistics data.

In 2003, NCHS selected 40 data fields to report on. The report includes the acceptable percentage of records (standard) that are not classifiable, blank and unknown. Standards are computed using criteria of multiplying the nationwide median for 1998 for a particular item, as a percentage of records received by NCHS, by a multiplier. The multiplier was 1.5 for 2003, which is 0.5 less than that of 2002. The following is an example of how the standard was computed for prenatal visits in different years.

Prenatal Visits	1998 Median (%)	2000 STND = 3X the Median for 1998	2001 STND = 2.5X the Median for 1998	2002 STND = 2X the Median for 1998	2003 STND = 1.5X the Median for 1998
	1.99	5.97	4.98	3.98	2.99

Since most births occur in hospitals and freestanding birth facilities, which are required to submit birth certificate data to the Arkansas Department of Health-Division of Vital Records, we wanted to generate an Arkansas-specific report by hospital of birth using the same standards supplied by NCHS. We also wanted to identify fields where Arkansas exceeds the NCHS standard for that particular year and also identify hospitals that exceed that standard. One senior analyst suggested that the report highlights fields that may potentially exceed the standard for both the state and individual hospitals.

For purposes of this paper, we have selected 8 birth certificate items that are looked at more often in analyzing preterm birth³. These are: clinical estimate of gestation, day last normal menses began, month last menses began, year last menses began, month prenatal care began, named month prenatal care began, prenatal visits and weight gain during pregnancy.

BEFORE ODS

Before we learned about ODS, we generated a similar report but used Microsoft Excel to present the tables. We categorized the selected variables, summarized the data using PROC SUMMARY and exported the data table to Excel. In Excel, we customized some Visual Basic for Applications (VBA) scripts generated by running user-defined Excel macros to color-shade cells where values exceeded

³ Arkansas has been experiencing a decline in preterm birth rate in the last five years. The accuracy and completeness of pertinent data is essential to analyzing the significance of the trend.

the standards. With the introduction of ODS and the powerful PROC REPORT, we thought of generating the report “by clicking only one button” entirely in a SAS environment.

DESCRIPTION OF THE SAS PROGRAM

Getting Started

```
OPTIONS PAGENO = 1 CENTER PAPERSIZE = LEGAL ORIENTATION = LANDSCAPE;  
LIBNAME birth 'path-to-server/birth database';  
%LET data = birth.birth2003;  
%LET path = C:\SCSUG;
```

To be able to generate a report with all your summarized variables (numbers and percents) lined up in one page, use PAPERSIZE = LEGAL ORIENTATION = LANDSCAPE options in the OPTIONS statement. The first %LET macro program statement, the simplest way to create and assign a value to a macro variable, is used to assign a value to the permanent birth data file and the second %LET is defining the path where you want to store your generated report (in a PDF file format, discussed later).

```
DATA temp (keep = ostate bhosp_ bloc gest gest1 menda menda1 menmo  
              menmo1 menyr menyr1 care care1 nammo nammo1  
              visits visits1 wtgain_ wtgain1 rec_err);  
    set &data (pw = *****);  
    if bloc not in ('1', '2') then bhosp_ = 'Non-Hosp';
```

This DATA step creates a birth work file and the KEEP =, a data step option, keeps the variables that you will be using throughout the program in the work dataset. The IF-THEN statement above recodes birth hospital numbers (bhosp_) for non-hospital births to 'Non-Hosp'. This will give an idea on the quality of non-hospital (mostly home births) birth certificate data.

```
/*  
IF-THEN-ELSE Statements:  
CREATE NEW VARIABLES WHERE VALID DATA ENTRIES  
WILL BE ASSIGNED '0s', WHILE NOT-CLASSIFIABLES,  
UNKNOWN, BLANKS AND OTHER INVALID ENTRIES WILL  
BE ASSIGNED '1s'  
*/  
if not ('02' le gest le '44') then gest1 = 1;  
else gest1 = 0;  
if not ('01' le menda le '31') then menda1 = 1;  
else menda1 = 0;  
if not ('01' le menmo le '12') then menmo1 = 1;  
else menmo1 = 0;  
if menyr in ('9999', ' ', '0000') then menyr1 = 1;  
else menyr1 = 0;
```

```

if not ('00' le care le '09') then care1 = 1;
else care1 = 0;
/*CODE ONLY IF "MONTH PRENATAL CARE BEGAN" IS BLANK*/
if care eq '' and not ('01' le nammo le '12') then nammo1 = 1;
else nammo1 = 0;
if not ('00' le visits le '97') then visits1 = 1;
else visits1 = 0;
if wtgain_ in (999, .) or wtgain_ gt 200 then wtgain1 = 1;
else wtgain1 = 0;
if gest1 + menda1 + menmo1 + menyr1 +
    care1 + nammo1 + visits1 + wtgain1 gt 0 then rec_err = 1;
else rec_err = 0;
RUN;

```

The final IF-THEN statement creates a new variable (rec_err) which is coded “1” if a birth record contains at least one invalid entry in the selected fields. Clean birth records are coded “0”.

Step 1: The Summary Procedure

```

/*****
STEP 1: THE SUMMARY PROCEDURE SUMMARIZES THE DATA
BY COMPUTING COUNTS AND PERCENTAGES
*****/
PROC SUMMARY data = temp;
    where ostate eq '004';
    class bhosp_;
    var gest1 -- rec_err;
    output out = summary
        (drop = _type_ rename = (_freq_ = Birth))
    sum = mean = / autoname;
RUN;

```

As we are interested in Arkansas birth hospitals only, the WHERE statement requests that the summarization be limited to births that occurred in Arkansas and bhosp_ (Birth Hospital Code) is the class variable in the CLASS statement. The range of variables listed in the VAR statement represents the selected birth certificate items (total = 8) for the report together with the newly created rec_err (true if record contains at least one invalid entry) - a total of 9 variables.

Request the output of the SUMMARY procedure be routed to a work dataset (summary) by using the OUTPUT OUT = statement. Since the automatically generated variable _TYPE_ has no use in this scenario (only one variable in the CLASS statement), we used DROP = option to drop it from the outputted dataset “summary”. You can use RENAME = option to rename another automatically

generated variable in PROC SUMMARY, `_FREQ_` to “birth”⁴ to indicate the number of births for each level in the `CLASS` variable. The `SUM =` and `MEAN =` options are the requested statistics for the variables listed in the `VAR` statement. They compute the counts and percentages, respectively. Note that the word “mean” may indicate statistical average but will work in this scenario since the data is categorical (1s or 0s). The `AUTONAME` option assigns the strings `_SUM` and `_MEAN` to generated variable names containing computed frequencies and proportions. We could have used the `AUTOLABEL` option as well, but the flexibility of `DEFINE` statements in PROC REPORT (discussed later in this paper) gives you more control on the appearance of column headers.

Step 2: Round and Sort

```

/*****
STEP 2: THIS DATA STEP AND ITS SUBSEQUENT ARRAY
STATEMENT AND ROUND FUNCTION ROUND THE COMPUTED
PERCENTAGES IN STEP 1 INTO 4-DIGITS AFTER THE DECIMAL POINT
*****/
DATA report1 (drop = i);
    set summary;
    array new (9) gest1_mean -- rec_err_mean;
    do i = 1 to 9;
        new (i) = round (new (i), 0.0001)*100;
    end;
    if bhosp_ eq 'Non-Hosp' then group = 1;
    else group = 0; *FORCES 'NON-HOSP' TO BE AT THE END ONCE SORTED;

PROC SORT data = report1;
    by group descending birth;
RUN;

```

The `ARRAY` statement in the previous `DATA` step utilizes the `ROUND` function to round the computed percentages to 4 digits after the decimal. The multiplication by 100 will display the data in a more readable format. Since larger medical centers are of more interest to users of such report (they submit larger numbers of birth certificates), you want to maintain them at the beginning of the report. But, at the same time, you may want to keep the “non-hospital” group at the bottom. To do that, create the temporary variable “group” (drop later) in the `DATA` step and then use `PROC SORT` to sort the data by group first (ascending by default-keeps the string “non-hosp” after the numbers in a character variable) and then by the total number of births “birth”. Request a descending sort by placing the `DESCENDING` option before “birth”. This keeps hospitals with larger numbers of births at the top.

⁴ Or, you can leave the variable `_FREQ_` in dataset “summary” in step 1 and label it using `DEFINE` statement in step 5

Step 3: Compare to Standard

```

/*****
STEP 3: IN THIS DATA STEP, WE CREATE 3 NEW VARIABLES:
1. "SCORE85" WHICH REPRESENTS THE NUMBER OF VARIABLES
   WHERE A HOSPITAL RATE OF REPORTING NON-CLASSIFIABLE,
   UNKNOWN, OR BLANK DATA FIELDS IS 85% TO EQUAL TO STANDARD,
2. "SCORE100": # OF VARS WHERE...EXCEEDS NCHS STANDARD AND
3. "EBC" WHICH REPRESENTS WHETHER THE HOSPITAL USES
   "ELECTRONIC BIRTH CERTIFICATE" SYSTEM OR NOT
*****/
DATA report2 (drop = group i);
  set report1;
  array scorex (8) gest1_mean -- wtgain1_mean;
  array standard (8) _temporary_ (1 17.78 5.64 5.03 2.24 2.24 2.99 7.79);

  score85 = 0;
  score100 = 0;

  do i = 1 to 8;
    if 0.85*standard (i) le scorex (i) le standard (i)
      then score85 = score85 + 1;
    else if scorex (i) gt standard (i)
      then score100 = score100 + 1;
  end;

  if bhosp_ in ('HOSPITAL-01', 'HOSPITAL-02', 'HOSPITAL-03',
               'HOSPITAL-04', 'HOSPITAL-05', 'HOSPITAL-06',
               'HOSPITAL-0X');
  then EBC = 'YES';
  else EBC = 'NO';

  if bhosp_ eq '' then do;
    bhosp_ = 'Total';
    EBC = 'N/A';
  end;

  if birth le 5 then delete;
RUN;
```

ARRAY “scorex” catalogs the percentages of the 8 selected DATA step variables while “standard” records the NCHS standard percentages. Note that we used the option `_TEMPORARY_` to create the list of standard percentages as temporary data elements. You can create new variables that analyses the characteristics of hospitals such as rural vs. urban, secondary vs. tertiary, etc. Here, we are using the IF-THEN argument again to classify hospitals as “Electronic Birth Certificate” vs. “Non-Electronic Birth Certificate” hospitals. Delete hospitals reported less than 5 births during the period of evaluation.

Step 4: Set Ranges for Color-Coding using PROC FORMAT

```

/*****
STEP 4: THE NEXT FORMAT PROCEDURE ASSIGNS COLORS BASED ON A DECISION RULE:
*ORANGE IF THE PERCENT OF A SPECIFIC VARIABLE IS 85% - EQUAL TO THE ACCEPTABLE NCHS
STANDARD AND,
*RED IF IT EXCEEDS THE NCHS STANDARD
*****/
PROC FORMAT;
  value gest    0.85-1      = orange 1.01-high = red other = black;
  value menda   15.11-17.78 = orange 17.96-high = red other = black;
  value menmo    4.79-5.64  = orange 5.70-high = red other = black;
  value menyr    4.28-5.03  = orange 5.08-high = red other = black;
  value care     1.90-2.24  = orange 2.26-high = red other = black;
  value nammo    1.90-2.24  = orange 2.26-high = red other = black;
  value visits   2.54-2.99  = orange 3.02-high = red other = black;
  value wtgain   6.62-7.79  = orange 7.87-high = red other = black;
RUN;

```

You can compute these ranges in SAS but we found Excel of great utility for such computations. The following figure is from the Excel spreadsheet where the computations in the FORMAT procedure were obtained.

	A	B	C	D	E	F	G
1			85% to equal STND = Orange		Above STND = Red		Other = Black
2		Standard	Lower	Upper	Lower	Upper	Other
3	EST GEST	1	0.85	1	1.01	high	Other
4	DAY LNM	17.78	15.11	17.78	17.96	high	Other
5	MTH LNM	5.64	4.79	5.64	5.70	high	Other
6	YR LNM	5.03	4.28	5.03	5.08	high	Other
7	MTH PRE CARE BEG	2.24	1.90	2.24	2.26	high	Other
8	NM MTH PRE CARE BEG	2.24	1.90	2.24	2.26	high	Other
9	PRENAT CARE VISITS	2.99	2.54	2.99	3.02	high	Other
10	WGT GAIN	7.79	6.62	7.79	7.87	high	Other

For the 85% to equal standard, the lower values for each variables were obtained by the Excel formula “=0.85*B3”. The upper values are the standards. For the above standard coding, lower values were obtained by the formula “=1.01*B3” while the upper values were set to “high”.

Step 5: Apply the *FORMAT* and other ODS style Definitions within PROC REPORT

(3) Like a VAR statement in PROC PRINT, COLUMN statement selects the arrangement of columns you want to present

```
ods listing close;
ods pdf file = "&path\SCSUG2004.pdf" notoc style = sasweb;
PROC REPORT data = report2 nowindows
  style (header)=[foreground=yellow font_weight=bold font_size=8pt];

  column bhospl_ birth EBC score100 score85 rec_err_sum rec_err_mean
         gest1_sum gest1_mean menda1_sum menda1_mean menmo1_sum menmo1_mean
         menyr1_sum menyr1_mean care1_sum care1_mean nammo1_sum nammo1_mean
         visits1_sum visits1_mean wtgain1_sum wtgain1_mean;
```

(1) Turn off the standard LISTING destination and activate a PDF destination with a SASWEB STYLE, which by default, generates a white FOREGROUND in column headers. Include the NOTOC option in the ODS PDF destination statement if you do not need a table of contents in your PDF file

(2) But, PROC REPORT gives you more control on the color of FOREGROUND, weight of FONT_WEIGHT, and size of FONT_SIZE.

```
define bhospl_/'Birth/Hospital';
define birth/'Birth/Count';

define score100/'Above/NCHS/Standard'
  style(header)=[foreground=red];

define score85/'85% to/Equal/Standard'
  style(header)=[foreground=orange];
```

(4) DEFINE statements describe how to use and display a report item. With the STYLE(*item*) = you can even control style elements (in ODS) for report items such as column headers. Here, we are requesting the column header for the variable "score100" be displayed in red, while column header for "score85" be displayed in orange. This serves as a "legend" of how to read the color-coded values in the report.

```
define rec_err_sum/'Records/with at/Least/1 Error';
define rec_err_mean/'Percent';

define gest1_sum/'Clinical/Estimate/of/Gestation';
define gest1_mean/'NCHS/Standard/=1.00%'
  style(column)=[foreground=gest. font_weight=bold]
  style(header)=[font_style=italic];

define menda1_sum/'Day/Last/Normal/Menses';
define menda1_mean/'NCHS/Standard/=17.78%'
  style(column)=[foreground=menda. font_weight=bold]
  style(header)=[font_style=italic];
```

(5) Remember, we did not use the AUTOLABEL option in PROC SUMMARY in step 1 because we wanted to take advantage of DEFINE statements. Here, we are inserting NCHS standards in the labels of the columns that contain the percentages. This works as a reference for comparison. Furthermore, we are applying the color-coding format (step 4) using the STYLE (COLUMN)= [FOREGROUND=format-name. option

*CONTINUE DEFINING THE REST OF THE VARIABLES THE SAME WAY;

```
title 'NATALITY NOT CLASSIFIABLE, UNKNOWN, AND BLANK DATA BY HOSPITAL: ARKANSAS 2003';
RUN;
ods pdf close;
ods listing;
quit;
```

(6) Add a title to your report using the TITLE statement. Always place the RUN statement before ODS statements. Do not forget to turn off the ODS PDF destination and turn on the LISTING destination.

THE FINAL PRODUCT

The next figures capture the generated report. The report is printed in a legal size paper with a landscape orientation.

NATALITY NOT CLASSIFIABLE, UNKNOWN, AND BLANK DATA BY HOSPITAL: ARKANSAS 2003

01:18 Tuesday, July 6, 2004 1

Birth Hospital	Birth Count	ESR	Above NCBS Standard	NCBS to Level Standard	Records with at Least 1 Error	Percent	Clinical Subsets of Completion	NCBS Standard $\pm 0.05\%$	Day Last Normal Menstruation	NCBS Standard $\pm 0.17\%$	Month Last Normal Menstruation	NCBS Standard $\pm 0.60\%$	Year Last Normal Menstruation	NCBS Standard $\pm 0.05\%$	Month Prenatal Care Began	NCBS Standard $\pm 0.50\%$	Neonatal Month Prenatal Care Began	NCBS Standard $\pm 0.50\%$	Prenatal Visits	NCBS Standard $\pm 0.50\%$	Weight Gain	NCBS Standard $\pm 0.75\%$
TOTAL	34290	N/A	1	0	4942	14.41	152	0.44	1439	4.2	1399	4.08	1345	3.92	571	1.87	70	0.2	575	1.88	3258	9.5
HOSPITAL-01	2262	YES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HOSPITAL-02	1977	YES	0	0	9	0.45	0	0	1	0.05	1	0.05	1	0.05	5	0.3	4	0.2	2	0.1	1	0.05
HOSPITAL-03	1964	YES	1	0	1465	74.54	1	0.06	2	0.1	2	0.1	2	0.1	22	1.12	19	0.97	2	0.1	1460	74.54
HOSPITAL-04	1783	YES	0	1	133	7.46	0	0	2	0.11	2	0.11	2	0.11	9	0.5	1	0.08	9	0.5	125	7.01
HOSPITAL-05	1555	YES	3	0	427	27.45	4	0.28	40	2.67	39	2.61	39	2.61	70	4.5	0	0	71	4.67	357	22.89
HOSPITAL-06	1482	YES	0	0	85	5.74	1	0.07	50	3.37	50	3.37	47	3.17	4	0.27	0	0	3	0.2	36	2.43
HOSPITAL-07	1482	YES	0	0	26	1.75	5	0.34	6	0.4	6	0.4	5	0.34	12	0.81	10	0.87	2	0.13	13	0.88
HOSPITAL-08	1428	YES	0	0	4	0.28	0	0	1	0.07	0	0	0	0	3	0.21	3	0.21	0	0	0	0
HOSPITAL-09	1242	YES	0	0	92	7.41	1	0.08	33	2.88	33	2.88	32	2.68	18	1.45	1	0.08	18	1.46	46	3.7
HOSPITAL-10	1228	YES	4	1	305	24.92	6	0.48	120	9.77	120	9.77	112	9.12	27	2.2	11	0.9	42	3.42	168	15.88
HOSPITAL-11	1113	YES	0	0	31	2.79	0	0	8	0.72	8	0.72	8	0.72	2	0.18	0	0	1	0.09	23	2.07
HOSPITAL-12	884	YES	6	0	411	46.49	5	0.67	352	39.82	352	39.82	331	37.44	26	2.94	0	0	75	8.48	72	8.14
HOSPITAL-13	745	YES	1	1	59	7.91	1	0.13	40	6.38	40	6.38	40	6.38	5	0.87	0	0	11	1.47	8	1.07
HOSPITAL-14	735	YES	6	0	183	24.9	25	3.4	61	8.3	61	8.3	61	8.3	62	8.44	0	0	31	4.22	73	9.93
HOSPITAL-15	724	YES	5	0	135	18.65	10	1.38	76	10.5	76	10.5	76	10.5	37	5.11	3	0.41	51	7.04	43	6.84
HOSPITAL-16	670	YES	3	1	202	30.15	1	0.16	90	13.43	90	13.43	79	11.79	13	1.94	0	0	11	1.84	148	22.09
HOSPITAL-17	630	YES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HOSPITAL-18	622	YES	0	0	38	6.11	1	0.18	0	0	0	0	0	0	4	0.84	0	0	3	0.48	34	6.47
HOSPITAL-19	595	YES	0	0	39	6.55	2	0.34	25	4.2	25	4.2	24	4.03	1	0.17	1	0.17	3	0.5	11	1.85
HOSPITAL-20	592	YES	0	0	14	2.36	3	0.51	4	0.68	4	0.68	4	0.68	7	1.18	1	0.17	0	0	1	0.17
HOSPITAL-21	572	YES	6	0	177	30.94	31	5.42	69	12.08	69	12.08	69	12.08	33	5.77	0	0	30	5.24	92	16.08
HOSPITAL-22	552	YES	4	0	72	13.04	2	0.36	63	11.41	63	11.41	63	11.41	51	8.24	1	0.18	23	4.17	21	3.8
HOSPITAL-23	535	YES	1	0	34	6.34	3	0.58	17	3.17	17	3.17	17	3.17	27	5.04	0	0	10	1.87	5	0.83
HOSPITAL-24	493	YES	5	0	145	29.51	1	0.2	66	13.39	66	13.39	66	13.39	31	5.29	0	0	69	14	47	8.63
HOSPITAL-25	471	YES	0	0	6	1.27	1	0.21	3	0.84	3	0.84	3	0.84	2	0.42	0	0	2	0.42	3	0.84
HOSPITAL-26	455	YES	2	0	74	16.25	1	0.22	20	4.4	20	4.4	18	3.98	7	1.64	0	0	19	4.18	37	8.13
HOSPITAL-27	453	YES	0	0	7	1.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1.55
HOSPITAL-28	440	YES	1	0	35	8.18	8	1.82	16	3.84	16	3.84	15	3.84	3	0.88	0	0	7	1.59	14	3.18
HOSPITAL-29	411	YES	0	2	25	6.33	0	0	23	6.8	20	4.97	20	4.97	2	0.48	0	0	0	0	3	0.73

Birth Hospital	Birth Count	ESR	Above NCBS Standard	NCBS to Level Standard	Records with at Least 1 Error	Percent	Clinical Subsets of Completion	NCBS Standard $\pm 0.05\%$	Day Last Normal Menstruation	NCBS Standard $\pm 0.17\%$	Month Last Normal Menstruation	NCBS Standard $\pm 0.60\%$	Year Last Normal Menstruation	NCBS Standard $\pm 0.05\%$	Month Prenatal Care Began	NCBS Standard $\pm 0.50\%$	Neonatal Month Prenatal Care Began	NCBS Standard $\pm 0.50\%$	Prenatal Visits	NCBS Standard $\pm 0.50\%$	Weight Gain	NCBS Standard $\pm 0.75\%$
HOSPITAL-30	394	YES	3	0	52	13.2	0	0	26	6.8	26	6.8	26	6.8	20	5.08	0	0	7	1.78	24	6.09
HOSPITAL-31	380	YES	1	4	54	14.21	9	2.37	19	5	19	6	18	4.74	7	1.84	0	0	10	2.83	26	8.84
HOSPITAL-32	351	YES	0	0	20	5.54	0	0	0	0	0	0	0	0	0	0	0	0	5	1.38	17	4.71
HOSPITAL-33	335	YES	1	0	79	23.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	23.51
HOSPITAL-34	335	YES	0	0	29	8.66	0	0	9	2.89	9	2.89	9	2.89	5	1.79	0	0	1	0.3	16	4.78
HOSPITAL-35	321	YES	0	0	2	0.62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.62
HOSPITAL-36	310	YES	0	0	10	3.23	0	0	9	2.9	9	2.9	8	2.68	0	0	0	0	0	0	2	0.65
HOSPITAL-37	295	NO	0	0	12	4.07	2	0.88	7	2.37	7	2.37	7	2.37	1	0.34	0	0	0	0	4	1.38
HOSPITAL-38	272	YES	3	0	73	26.84	0	0	1	0.37	1	0.37	1	0.37	9	3.31	0	0	19	5.99	60	22.06
HOSPITAL-39	271	NO	1	0	21	7.75	3	1.11	5	1.8	5	1.86	5	1.86	2	0.74	0	0	1	0.37	11	4.08
HOSPITAL-40	255	YES	3	0	31	12.15	0	0	29	11.37	29	11.37	29	11.37	8	3.14	0	0	5	1.98	0	0
HOSPITAL-41	252	YES	0	0	4	1.59	0	0	3	1.19	3	1.19	3	1.19	0	0	0	0	0	0	1	0.4
HOSPITAL-42	244	YES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HOSPITAL-43	232	YES	1	1	54	23.28	0	0	12	6.17	11	4.74	10	4.31	2	0.88	2	0.88	2	0.88	44	18.97
HOSPITAL-44	205	YES	3	0	33	16.1	0	0	21	10.24	21	10.24	21	10.24	0	0	0	0	0	0	16	7.8
HOSPITAL-45	179	YES	0	0	2	1.12	0	0	0	0	0	0	0	0	1	0.68	0	0	1	0.68	1	0.68
HOSPITAL-46	170	NO	4	1	29	17.05	6	3.63	21	12.35	16	9.41	16	9.41	5	2.94	3	1.78	5	2.94	10	6.88
HOSPITAL-47	167	YES	3	3	35	20.96	2	1.2	9	6.39	9	6.39	8	4.79	5	2.99	1	0.8	5	2.99	28	16.77
HOSPITAL-48	154	YES	0	0	9	5.84	0	0	6	3.9	6	3.9	6	3.9	2	1.3	0	0	3	1.95	4	2.8
HOSPITAL-49	152	NO	1	0	15	10.53	3	1.97	6	3.85	5	3.29	5	3.29	2	1.32	0	0	3	1.97	9	6.82
HOSPITAL-50	127	YES	0	0	5	3.94	0	0	2	1.67	2	1.67	2	1.67	1	0.79	0	0	0	0	2	1.67
HOSPITAL-51	124	NO	0	0	6	4.84	0	0	4	3.23	4	3.23	4	3.23	1	0.81	0	0	1	0.81	3	2.42
HOSPITAL-52	87	NO	3	0	13	14.94	1	1.16	12	13.79	6	8.9	6	8.9	0	0	0	0	1	1.16	1	1.16
HOSPITAL-53	81	YES	0	0	4	4.94	0	0	0	0	0	0	0	0	1	1.23	0	0	0	0	4	4.84
HOSPITAL-54	67	NO	5	0	21	31.34	0	0	19	28.38	4	5.97	4	5.97	3	4.48	0	0	3	4.48	2	2.89
HOSPITAL-55	64	NO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HOSPITAL-56	32	YES	2	0	2	6.25	0	0	2	8.25	2	8.25	2	8.25	0	0	0	0	0	0	0	0
HOSPITAL-57	17	NO	2	0	5	29.41	1	5.88	4	23.53	0	0	0	0	0	0	0	0	0	0	1	6.88
HOSPITAL-58	7	NO	3	0	2	28.57	0	0	1	14.29	1	14.29	1	14.29	0	0	0	0	1	14.29	0	0
NON-HOSPITAL	290	NO	6	0	77	26.55	11	3.79	23	7.85	21	7.24	19	6.65	11	3.79	9	3.1	7	2.41	40	13.78

NATALITY NOT CLASSIFIABLE, UNKNOWN, AND BLANK

Birth Hospital	Birth Count	EBC	Above NCHS Standard	88% to Equal Standard	Records with at Least 1 Error	Percent	Clinical Estimate of Gestation	NCHS Standard =1.00%	Day Last Normal Menses	NCHS Standard =17.78%	Month Last Normal Menses	NCHS Standard =5.64%
TOTAL	34290	N/A	1	0	4942	14.41	152	0.44	1439	4.2	1399	4.08
HOSPITAL-01	2262	YES	0	0	0	0	0	0	0	0	0	0
HOSPITAL-02	1977	YES	0	0	9	0.46	0	0	1	0.05	1	0.05
HOSPITAL-03	1964	YES	1	0	1466	74.64	1	0.05	2	0.1	2	0.1
HOSPITAL-04	1783	YES	0	1	133	7.46	0	0	2	0.11	2	0.11
HOSPITAL-05	1555	YES	3	0	427	27.46	4	0.26	40	2.57	39	2.51
HOSPITAL-06	1482	YES	0	0	85	5.74	1	0.07	50	3.37	50	3.37
HOSPITAL-07	1482	YES	0	0	26	1.75	5	0.34	6	0.4	6	0.4
HOSPITAL-08	1428	YES	0	0	4	0.28	0	0	1	0.07	0	0
HOSPITAL-09	1242	YES	0	0	92	7.41	1	0.08	33	2.66	33	2.66
HOSPITAL-10	1228	YES	4	1	306	24.92	6	0.49	120	9.77	120	9.77
HOSPITAL-11	1113	YES	0	0	31	2.79	0	0	8	0.72	8	0.72
HOSPITAL-12	884	YES	6	0	411	46.49	5	0.57	352	39.82	352	39.82
HOSPITAL-13	746	YES	1	1	59	7.91	1	0.13	40	5.36	40	5.36
HOSPITAL-14	735	YES	6	0	183	24.9	25	3.4	61	8.3	61	8.3

UNKNOWN, AND BLANK DATA BY HOSPITAL: ARKANSAS 2003

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Day Last Normal Menses	NCHS Standard =17.78%	Month Last Normal Menses	NCHS Standard =5.64%	Year Last Normal Menses	NCHS Standard =5.03%	Month Prenatal Care Began	NCHS Standard =2.24%	Named Month Prenatal Care Began	NCHS Standard =2.24%	Prenatal Visits	NCHS Standard =2.99%	Weight Gain	NCHS Standard =7.79%
1439	4.2	1399	4.08	1345	3.92	571	1.67	70	0.2	576	1.68	3258	9.5
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.05	1	0.05	1	0.05	6	0.3	4	0.2	2	0.1	1	0.05
2	0.1	2	0.1	2	0.1	22	1.12	19	0.97	2	0.1	1460	74.34
2	0.11	2	0.11	2	0.11	9	0.5	1	0.06	9	0.5	125	7.01
40	2.57	39	2.51	39	2.51	70	4.5	0	0	71	4.57	357	22.96
50	3.37	50	3.37	47	3.17	4	0.27	0	0	3	0.2	36	2.43
6	0.4	6	0.4	5	0.34	12	0.81	10	0.67	2	0.13	13	0.88
1	0.07	0	0	0	0	3	0.21	3	0.21	0	0	0	0
33	2.66	33	2.66	32	2.58	18	1.45	1	0.08	18	1.45	46	3.7
120	9.77	120	9.77	112	9.12	27	2.2	11	0.9	42	3.42	168	13.68
8	0.72	8	0.72	8	0.72	2	0.18	0	0	1	0.09	23	2.07
352	39.82	352	39.82	331	37.44	26	2.94	0	0	75	8.48	72	8.14
40	5.36	40	5.36	40	5.36	5	0.67	0	0	11	1.47	8	1.07
61	8.3	61	8.3	61	8.3	62	8.44	0	0	31	4.22	73	9.93
76	10.5	76	10.5	76	10.5	37	5.11	3	0.41	51	7.04	43	5.94
90	13.43	90	13.43	79	11.79	13	1.94	0	0	11	1.64	148	22.09

CONCLUSION

In Maternal and Child Health (MCH) research, edited and complete birth data produces more accurate and significant results. Arkansas Center for Health Statistics and the Division of Vital Records are highly rated from the National Center for Health Statistics (NCHS) in regard to the accuracy and completeness of their data. To carry out quality MCH research for Arkansas citizens and to maintain these high ratings, the center evaluates the performance of birth hospitals concerning submitting invalid data in birth certificates. To accomplish that, they are putting SAS and its Output Delivery System (ODS) to use.

The introduction of ODS motivated us to move from the multi-step SAS-Excel process of generating color-coded data quality reports by hospital of birth to an all-in-one process using PROC REPORT. The REPORT procedure combines features of the PRINT, MEANS, and TABULATE procedures with features of the DATA step in a single report-writing tool. In this project, we are not using all of these features, nevertheless; the incorporation of color-coding formats into PROC REPORT is of exceptional utility for users of periodical reports in which certain levels of performance need to be highlighted.

The default features provided by ODS in the different versions of SAS are convenient and can fit any report. To create customized reports, however, you may need to alter or modify defaults using the flexibility of ODS style definitions. PROC REPORT is an excellent venue to use these style definitions.

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