Paper 026-2008

Tailored Online Solutions to Meet the Clients Data Analysis Needs using SAS/IntrNet®

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ABSTRACT

The Centers for Disease Control and Prevention (CDC) originally designed a system, named PONDER, that was menu-driven and contained a series of preprogrammed analyses that were accessed through drop-down menus. The PONDER system was decommissioned only because of a Y2K issue on its host mainframe. RTI International (RTI) took advantage of the advancements made in available technologies to create a tool to enable researchers and policymakers to process data and view the results in a context-appropriate format for the CDC PRAMS project. PRAMS (Pregnancy Risk Assessment Monitoring System) monitors selected maternal experiences and behaviors that occur before and during pregnancy and during a child's early infancy.

RTI developed an online analysis tool, PONDER (PRAMS On-Line Data for Epidemiologic Research), which presents analyses tailored to the research question and offers an intuitive point-and-click interface that encourages researchers and policymakers to use their existing data to plan and assess perinatal health programs. PONDER uses SAS®, including SAS/IntrNet® as the foundation for the web-based tools, XHTML, HSQL, JavaScript and SUDAAN®. PONDER seamlessly incorporates these technologies to provide a user-friendly interface that allows easy navigation of the analytical interface and associated documentation; includes informational and help text that allows novice and expert users to easily navigate the system; allows results to be displayed in tabular or graphical format or saved as Microsoft Excel tables for additional manipulation; ensures scalability and reliability; and enables developers to respond quickly to add statistical techniques and complex data series.

INTRODUCTION

To help monitor selected maternal experiences and behaviors that occur before and during pregnancy and during a child's early infancy, the Centers for Disease Control and Prevention (CDC) began collecting state-specific, population-based data from state health departments on maternal attitudes and experiences before, during, and shortly after pregnancy. The PRAMS (Pregnancy Risk Assessment Monitoring System) database contains the data collected.

To help researchers access the information, CDC originally designed a menu-driven system that contained a series of preprogrammed analyses that users accessed through drop-down menus. The original system, called PONDER (PRAMS On-Line Data for Epidemiologic Research), was decommissioned because of a Y2K issue on its host mainframe.

CDC decided to revive PONDER and contracted with RTI International (RTI) to use the most recent technological advancements to create a tool that would allow researchers and policymakers to process PRAMS data and view the results in a context-appropriate format. CDC, along with RTI, developed PONDER's intuitive point-and-click interface to encourage researchers and policymakers to use the collected data to plan and assess perinatal health programs.

PONDER combines XHTML, HSQL, JavaScript, SAS and SUDAAN® programming to provide users with the best possible experience while navigating both the analytical interface and the associated documentation. RTI's SUDAAN software, combined with SAS, provides users with powerful tabular and graphing features. PONDER's interface has related informational and help text at each step to allow both new and expert users to navigate the system. The conceptual standard scheme for the PONDER system web application using the SAS/IntrNet Application Dispatcher is described in detail by Henderson [1].

In recent years, researchers and scientists have begun developing and refining online analytical applications using SAS/IntrNet [2-4]. The advantages of dynamic retrieval of case reports forms was demonstrated by Bednarski et al. [2]; however, no statistics were calculated in this study. The flexibility of SAS/IntrNet in creating standardized reports was demonstrated by Winn [3], but data analysis capabilities were not included. In addition, query components of the web tool were analyzed by Ranson and Wai Ming [4].

SYSTEM DESCRIPTION

RTI used SAS, including SAS/IntrNet, as the foundation for PONDER's web-based tools, which include XHTML, HSQL, JavaScript, and SUDAAN, which when combined with SAS, provides the tabular and graphic analysis products.

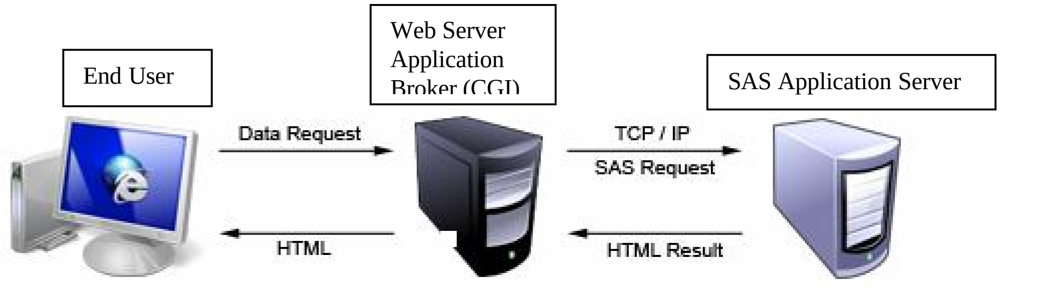


Figure 1. End User/Web Browser, Web Server Application Broker (CGI), and SAS Application Server

RTI based the PONDER intranet application on SAS/IntrNet architecture, which contains the SAS Application Dispatcher.

The Application Dispatcher has two components: the Application Broker, which resides on the web server and communicates between the browser and the SAS Application Server; and the SAS/IntrNet computer server, which is a SAS program on the SAS application server.

PONDER uses Data Services by executing the HSQL CGI (Common Gateway Interface program) on the web server. The parameters from the HTML become the values of macro variables, which are then passed to the SAS program, which executes the SAS and SUDAAN procedures and produces the complex reports. Then, the dynamically generated HTML outputs are sent back to the user. These outputs include tables and graphs.

PONDER allows researchers, scientists, and policymakers to process data and display the results in a context-appropriate format. By presenting the analysis in a manner that is tailored to the research question, PONDER provides maximum value to the user.

PONDER's ease of use encourages researchers to use data the CDC has collected and is continuing to collect regularly. Using the wealth of data already accumulated can help researchers focus on analysis and outcomes.

SCALABILITY AND RELIABILITY

Using dynamic SAS/IntrNet applications as the foundation for our web-based tools ensures scalability and reliability.

Researchers generally understand that the more complex a query they make, the more likely it is they may generate inconsistent and varied results because of input errors and other factors.

PONDER reduces this margin of error because the user makes selections from drop-down menus, which reduces input errors like typographical errors. We also tested the system using various types of data.

The system also works relatively quickly because the data are stored separately for each state-year combination, and it takes only a few minutes of the user's time to produce the results. Also, users can increase the number of variables and state-year data sets on demand. Because each state-year data set and each variable are handled independently, PONDER seamlessly adds new files and variables to the list of already created ones. PONDER can also respond quickly when alternative statistical techniques or complex data series are required. If additional statistics are requested, the programmer needs only to add appropriate options to the SUDAAN code embedded in the SAS program and modify the SAS program format according to established standards.

If we had not used SAS/IntrNet combined with SUDAAN, we would have had to create and save to disk 131,335,948,800, or approximately 233*233*24*24*350*12 ~ 10**^{11} report combinations because of the number of variables and frequencies:

- 233 research variables,

- 232 other variables + single frequencies (1 variable),
- 24 control variables, 24 secondary control variables,
- 350 state-year combinations, and
- 12 available statistics.

ANALYSIS PRODUCTS

PONDER runs analyses and creates reports in real time. Users can specifically define what output they wish to display. Once the user selects analysis parameters, PONDER creates and runs a SUDAAN procedure to generate results and produce a corresponding report.

A feature of PONDER especially useful to researchers, analysts, and policymakers is its ability to display results in readily readable, easy to interpret tables and graphs. After performing a cross-tabulation or means procedure, users can save the results as the following:

- an Excel spreadsheet, which can be downloaded from the web site and saved in .csv format or an Excel file;
- a graph, which users save by right clicking on the graph and choosing “Save Picture As…” and selecting either gif or bitmap format; or
- a table.

PONDER’s web-based query system lets users design their analysis by choosing from a carefully indexed list of variables and selecting statistics to include in the report. One of PONDER’s salient features is how it incorporates RTI’s SUDAAN (Version 9) software to generate analyses and produce estimates and standard errors that take into account the PRAMS’ complex sampling design. SUDAAN is statistical software for analyzing correlated data, including correlated data in complex sample surveys. SUDAAN's strength is its ability to compute standard errors of ratio estimates, means, totals, regression coefficients, and other statistics according to the sample design. We were able to incorporate SUDAAN’s procedures easily into the SAS code.

PONDER users can perform two types of analysis: cross-tabulation and means. Users can select 233 variables by class and topic, including most of the core and created PRAMS analysis variables. More common state selected variables are available for those states that use them. In addition, there are 24 control variables for use in controlling or stratifying the requested analysis. Indexing makes it easier for the user to find a desired variable within the data dictionary. For example, classes represent high-level categories of topics, and topics further refine the listing.

User can also select statistics to include in their analysis, including

- sample size,
- weighted sample size, and
- a number of standard errors.

Users can access online help at each step of their analysis.

WEB PAGE DESIGN

The PONDER web page was designed in conjunction with and guidance and input from CDC personnel, and with suggestions from projected users. In addition, RTI brought to bear a wealth of experience and knowledge in developing user friendly web interfaces. Our goal was to create an interface that the experienced web user and researcher as well as new investigators and other interested parties could use effectively. To achieve this, we used visual elements that included drop-down menus, highlighted instructions, and readily available help text.

After accessing the web site, users must enter their user id and password. Access to the web site is restricted to three classes of users:

- PRAMS users from the CDC, who can use any state’s data in an analysis;
- authorized users from individual states; and
- authorized users from other states that have mutual data sharing agreements.

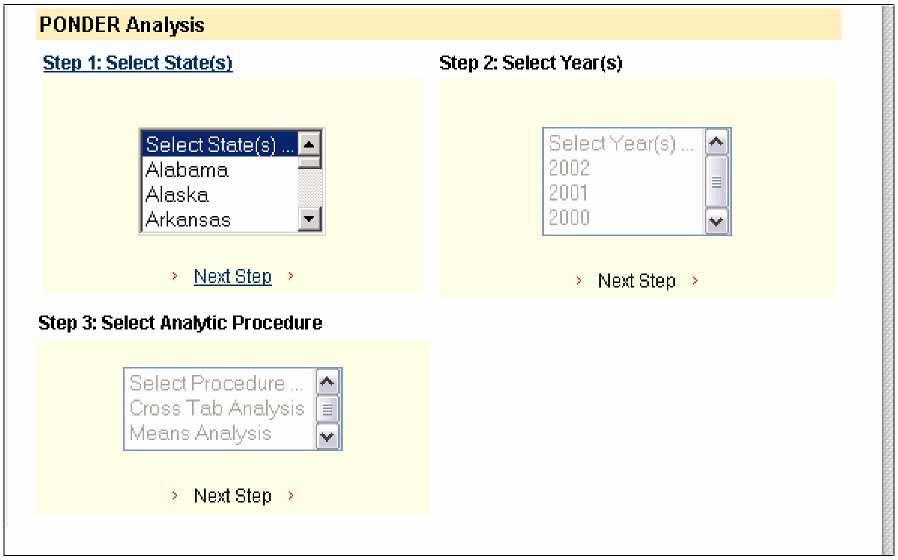
Figure 2 shows the web page as the user sees it after his or her security credentials are validated.

Users will select:

- one or more states (Step 1),

- one ore more years (Step 2), and
- the name of the analytical procedure for this specific analysis (Step 3).

Steps 2 and 3 are enabled as the user makes selections. The data for that web page is selected from the “states” and “years” SAS data sets, which are modified when new states or years are added to the system.



PONDER Analysis

Step 1: Select State(s)

Select State(s) ...
Alabama
Alaska
Arkansas

› Next Step ›

Step 2: Select Year(s)

Select Year(s) ...
2002
2001
2000

› Next Step ›

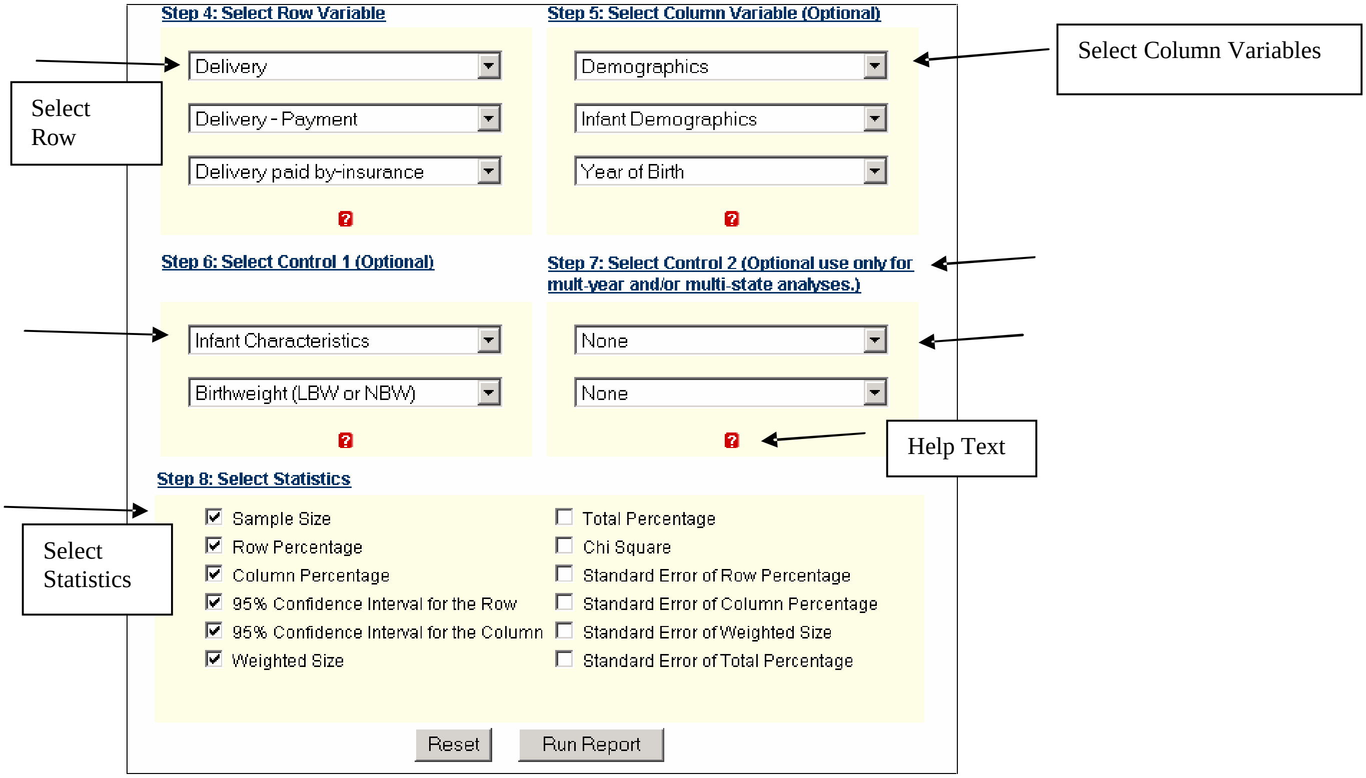
Step 3: Select Analytic Procedure

Select Procedure ...
Cross Tab Analysis
Means Analysis

› Next Step ›

Figure 2. Opening Screen of PONDER

Beginning with Figure 3 below, we show an example of the cross-tabulation analysis procedure. Users can select statistics through 10 check boxes, and can select single or multiple cross-tabulation.



Step 4: Select Row Variable

Delivery
Delivery - Payment
Delivery paid by-insurance

Step 5: Select Column Variable (Optional)

Demographics
Infant Demographics
Year of Birth

Step 6: Select Control 1 (Optional)

Infant Characteristics
Birthweight (LBW or NBW)

Step 7: Select Control 2 (Optional use only for mult-year and/or multi-state analyses.)

None
None

Step 8: Select Statistics

☑ Sample Size
☑ Row Percentage
☑ Column Percentage
☑ 95% Confidence Interval for the Row
☑ 95% Confidence Interval for the Column
☑ Weighted Size
☐ Total Percentage
☐ Chi Square
☐ Standard Error of Row Percentage
☐ Standard Error of Column Percentage
☐ Standard Error of Weighted Size
☐ Standard Error of Total Percentage

Select Row

Select Column Variables

Help Text

Select Statistics

Figure 3. PONDER Analysis Screen 2 with Sample Variables

The CDC and RTI worked hard to institute the graduated, orderly steps that users follow selecting data and requesting their analysis. Each Step has a clickable header that leads to explanatory text, and question mark symbols that lead to additional help text.

In the screen presented in Figure 3, we see the headers for steps 4 through 8.

Step 4 (Select Row Variable) illustrates the depth of analysis available to the user.

Users can select more than:

- 200 categorical variables for a row or column in cross-tabulation, and
- 30 continuous variables in the means analyses.

These are grouped into 39 topic areas, which are grouped into 11 broader topic areas called classes. In addition, users can control or stratify their analysis with more than 20 control variables grouped into 7 topic areas.

The first selection, classes, represents high-level categories of topics. Then, topics further refine the listing under which variables are grouped. This indexing makes finding variables in the data dictionary easier, as noted above.

For example, if the user chooses the delivery class out of 11 other classes in the first drop-down, (e.g., demographics, family planning, etc.), he or she can choose between delivery-payment and hospital length-of-stay topics specific to the delivery class in the second drop-down menu. Further, if the user selects delivery-payment topic in the second drop-down, he or she can select from 11 variables (e.g., Delivery paid by-insurance, Delivery paid by-income, Mom-nights spent in hospital) in the third drop-down menu.

The selection of all these variables was determined by delivery class. Based on these three selections, users determine the row variable they are interested in. If the user selects the demographics class, the second (Step 5) and the third drop-down menus (Step 6) will contain other options.

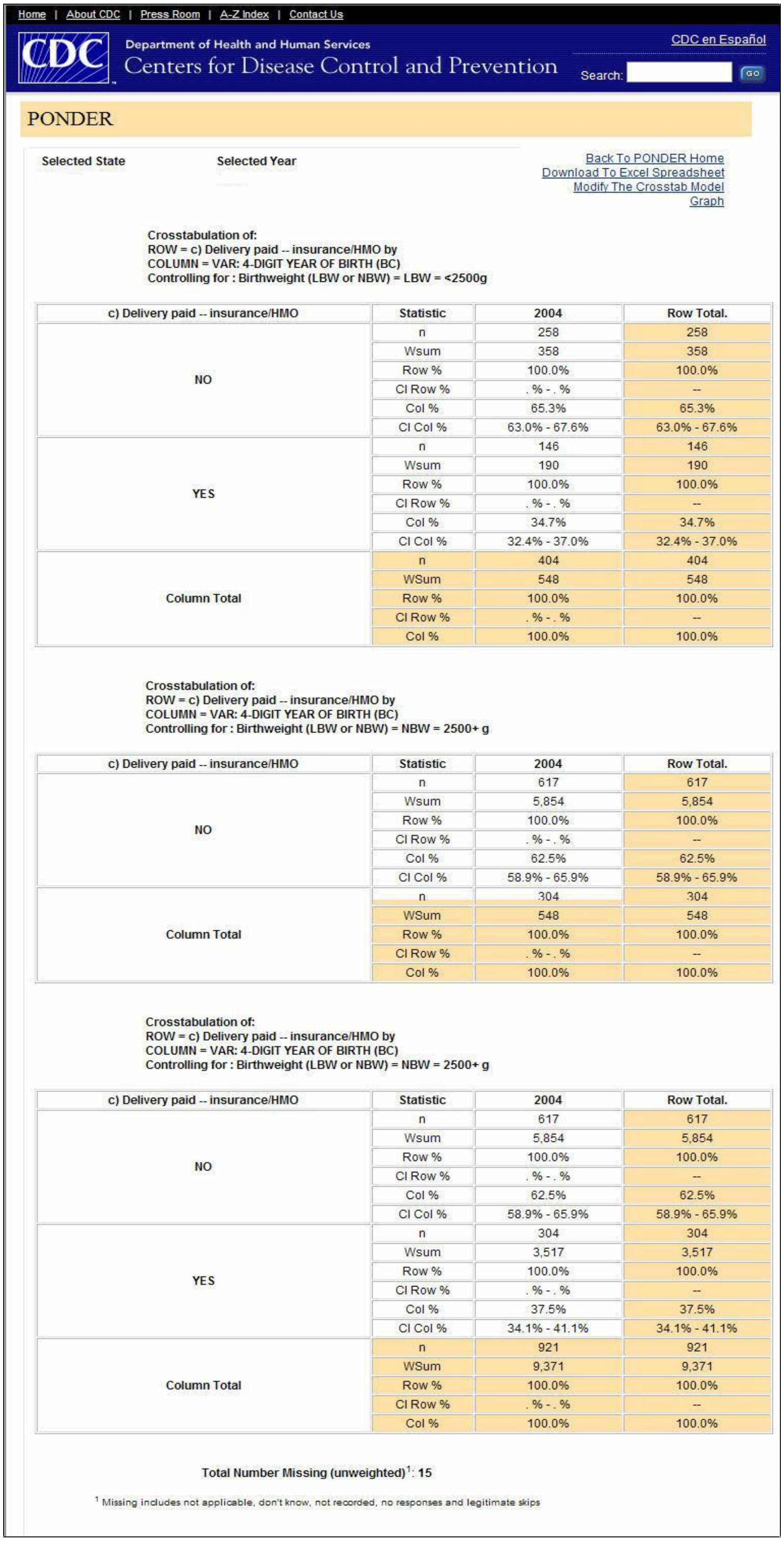
The data sets prepared by RTI are transformed and stored in the SAS data repository. The variables are selected from a metatable data set that lists all the variables, topics, and classes. It also provides the flags, which indicate whether a variable can be used as a row, column, or control selection. The table below gives examples of variables from the metatable data set.

varname	Row	Column	Control	Class	Topic	Label
BBY_HOSP	1	1	0	Delivery	Hospital Length of Stay	Baby-Nights in hospital at birth
BCB_HUSB	1	1	0	Family Planning	Contraception - Postpartum	Postpartum BC barriers-husband doesn't want
BCB_INFT	1	1	0	Family Planning	Contraception - Postpartum	Postpartum BC barriers-thinks sterile
BCB_NSEX	1	1	0	Family Planning	Contraception - Postpartum	Postpartum BC barriers-not having sex

Table 1. Variables from the Metatable Data Set

The system uses HSQL to load the drop-down menus (Figure 3) for the analysis variables.

Users can also define what output they wish to display. Once all analysis parameters are selected, the PONDER system creates and runs a SUDAAN procedure that is called by SAS/IntrNet. SAS/IntrNet then generates the analysis and produces the corresponding report shown in Figure 4.


Home | About CDC | Press Room | A-Z Index | Contact Us
CDC
Department of Health and Human Services
Centers for Disease Control and Prevention
CDC en Español
Search:
GO

PONDER

Selected State

Selected Year

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Download To Excel Spreadsheet
Modify The Crosstab Model
Graph

Crosstabulation of:
ROW = c) Delivery paid -- insurance/HMO by
COLUMN = VAR: 4-DIGIT YEAR OF BIRTH (BC)
Controlling for : Birthweight (LBW or NBW) = LBW = <2500g

c) Delivery paid -- insurance/HMO	Statistic	2004	Row Total.
NO	n	258	258
	Wsum	358	358
	Row %	100.0%	100.0%
	CI Row %	. % - . %	--
	Col %	65.3%	65.3%
	CI Col %	63.0% - 67.6%	63.0% - 67.6%
YES	n	146	146
	Wsum	190	190
	Row %	100.0%	100.0%
	CI Row %	. % - . %	--
	Col %	34.7%	34.7%
	CI Col %	32.4% - 37.0%	32.4% - 37.0%
Column Total	n	404	404
	WSum	548	548
	Row %	100.0%	100.0%
	CI Row %	. % - . %	--
	Col %	100.0%	100.0%

Crosstabulation of:
ROW = c) Delivery paid -- insurance/HMO by
COLUMN = VAR: 4-DIGIT YEAR OF BIRTH (BC)
Controlling for : Birthweight (LBW or NBW) = NBW = 2500+ g

c) Delivery paid -- insurance/HMO	Statistic	2004	Row Total.
NO	n	617	617
	Wsum	5,854	5,854
	Row %	100.0%	100.0%
	CI Row %	. % - . %	--
	Col %	62.5%	62.5%
	CI Col %	58.9% - 65.9%	58.9% - 65.9%
Column Total	n	304	304
	WSum	548	548
	Row %	100.0%	100.0%
	CI Row %	. % - . %	--
	Col %	100.0%	100.0%

Crosstabulation of:
ROW = c) Delivery paid -- insurance/HMO by
COLUMN = VAR: 4-DIGIT YEAR OF BIRTH (BC)
Controlling for : Birthweight (LBW or NBW) = NBW = 2500+ g

c) Delivery paid -- insurance/HMO	Statistic	2004	Row Total.
NO	n	617	617
	Wsum	5,854	5,854
	Row %	100.0%	100.0%
	CI Row %	. % - . %	--
	Col %	62.5%	62.5%
	CI Col %	58.9% - 65.9%	58.9% - 65.9%
YES	n	304	304
	Wsum	3,517	3,517
	Row %	100.0%	100.0%
	CI Row %	. % - . %	--
	Col %	37.5%	37.5%
	CI Col %	34.1% - 41.1%	34.1% - 41.1%
Column Total	n	921	921
	WSum	9,371	9,371
	Row %	100.0%	100.0%
	CI Row %	. % - . %	--
	Col %	100.0%	100.0%

Total Number Missing (unweighted)[1]: 15

[1] Missing includes not applicable, don't know, not recorded, no responses and legitimate skips

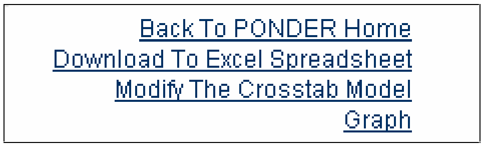
Figure 4. PONDER Analysis Product—Tables

Using the current URL string, the SAS program receives a list of symbols entered by the user. The SUDAAN procedure is then run, requesting statistics and outputs data be put into a SAS data set. The program reads the SAS data set and displays the requested report.

In the example listed above (Figure 4), the user has selected a report for the cross-tabulation of “C-Delivery paid by--Insurance or HMO” by “4-DIGIT YEAR OF BIRTH (BC)” variables, and “Birthweight (LBW or NBW)” is the control variable. The statistics selected were as follows:

- sample size,
- row percentage,
- column percentage,
- 95% confidence interval for the row,
- 95% confidence interval for the column, and
- weighted size.

At this point, the user can choose to have results displayed in tabular or graphical format or/and saved as Microsoft Excel tables for additional manipulation. These options are presented to the user in the top right corner of the report.



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Download To Excel Spreadsheet
Modify The Crosstab Model
Graph

Figure 5. PONDER Navigation and Product Selection Box

If the user selects the graph, the SAS broker calls the graph program that displays a list of options. On the form in Figure 6, the user can select the graph type and statistics to be used in the graph.

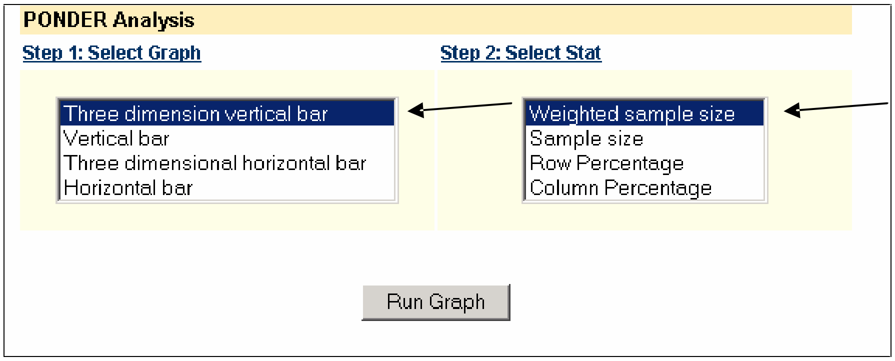
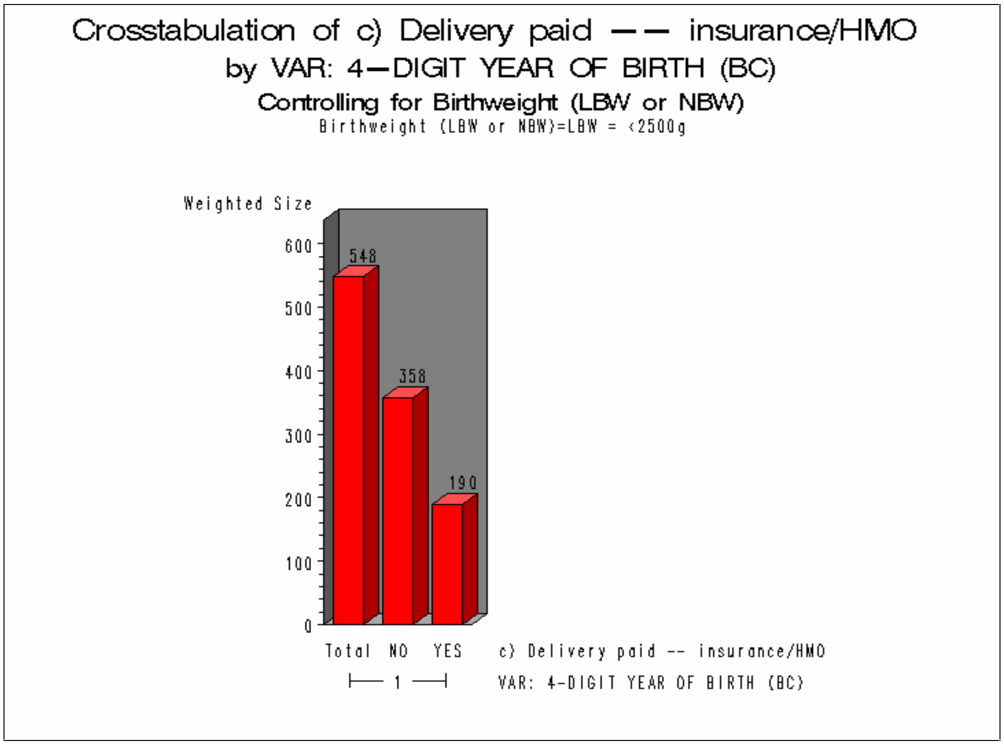


Figure 6. PONDER Analysis Screen

Figure 7 shows a graph that was created in real time. In the example provided below, the user selected the “Three dimension vertical bar” and the “Weighted sample size” options.



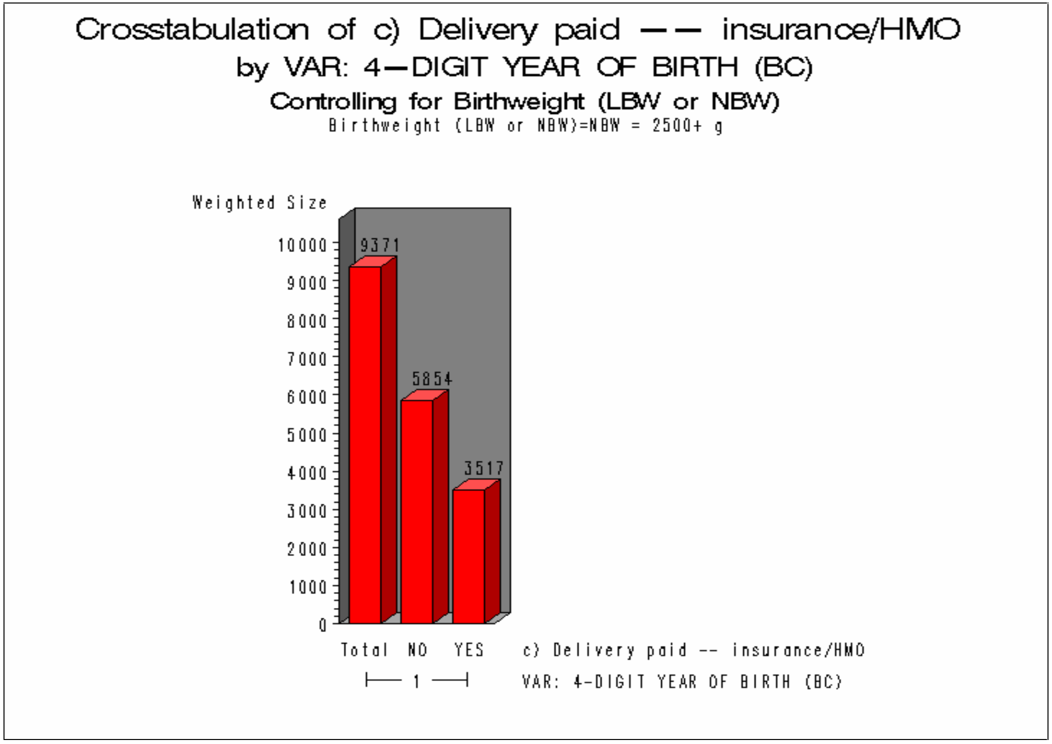


Figure 7. PONDER Analysis Product—Graph

EXCERPTS FROM THE SAS CODE

After the user selects all variables and statistics from the screen presented in Figure 3, the PONDER system passes them to the SAS program via the URL string, where variables are separated by “&.” A typical URL string received by the SAS program is presented below:

URL:

```
&row_class=Delivery&row_topic=DeliveryPayment&row=PD_IHMO&col_class=Demographics&col
_topic=Infant+Demographics&column=YY4_DOB&control1_class=Infant+Characteristics&cont
rol1=BIRTHWGT&control2_class=&control2=&SampleSize=on&RowPercentage=on&ColumnPercent
age=on&conf_inter_row=on&conf_inter_col=on&WeightedSize=on
```

As we see, the value of the row_class macro variable is “Delivery,” the value of the row_topic macro variable is "DeliveryPayment," and so forth.

After that, the SUDAAN procedure is run using the SAS macro variables extracted from the URL string to generate the user’s requested statistics. The output SAS data set is produced directly from SUDAAN.

Here is a sample of the callable SUDAAN procedure for calculating cross-tabulations for the SAS xtabdata dataset. We use design=strwor if any of the strata contain large sampling fractions. The noprint option indicates that the report will only be saved into the data set.

```
proc crosstab data=xtabdata filetype=sas design=strwor noprint;
 nest
 stratumc / missunit;
 totcnt totcnt;
 samcnt samcnt ;
 weight wtanal;
```

Here, “nest” lists in order the variable gd(s) whose values identify the design stages (by which the data file must be sorted), stratumc is the stratified variable, totcnt lists in order the variable(s) whose values are the population counts at each sampling stage, samcnt lists in order the variable(s) whose values are the sample counts at each sampling stage, weight identifies the variable whose values and the analysis weights are used in computing.

Depending on the availability of SAS macro variables, the program dynamically sets the subgroups, levels, and tables statements as follows:

```
subgroup
%if "&control1" ne "" %then %do;
 &control1
%end;
&row &column ;
 levels
%if "&control1" ne "" %then %do;
 &control1level
%end;
 &rowlevel &columnlevel;
 tables
%if "&control1" ne "" %then %do;
&control1 *
%end;
&row * &column;
 output nsum wsum rowper colper totper lowrow uprow lowcol upcol
```

Then, depending on the availability of the macro variables selected, the program dynamically selects statistics requested by the user.

```
%if "&StdErrorWeightedSize" = "on" %then %do;
              sewgt
%end;
%if "&StdErrorTotalPercentage" = "on" %then %do;
               setot
%end;
%if "&StdErrorRowPercentage" = "on" %then %do;
              serow
%end;
```

```
%if "&StdErrorColumnPercentage" = "on" %then %do;
               secol
%end;
```

The “out_freq” SAS data set, which is the statistical report, is created by the SUDAAN procedure. Below is a partial listing of the SUDAAN report.

TABLENO	Z_TKLABR	BIRTHWGT	_C1	_C2	_C3	NSUM	WSUM	ROWPER	LOWROW	UPROW
1	0	-2	0	-2	-2	997	76483.57	100.00	.	.
1	NO	-2	1	-2	-2	145	8657.61	11.32	9.11	13.98
1	YES	-2	1	-2	-2	852	67825.96	88.68	86.02	90.89
2	0	LBW = <2500g	0	1	-2	448	6141.64	100.00	.	.
2	NO	LBW = <2500g	1	1	-2	87	1159.22	18.87	15.58	22.68

Table 2. SUDAAN Report—Partial Listing

Here,

- “nsum” is the sample size,
- “wsum” is the weighted size,
- “rowper” is the row percentage,
- “lowrow” is the low percentage, and
- “uprow” is the upper percentage.

Further, the program reads the report created by SUDAAN, tailors it to the client’s specifications, and outputs results to the web. Here is the code:

```
data _null_;
set out_freq end = end;
   file _webout;
```

Using the symbols extracted from URL, the program dynamically writes the code. For example, if “&control1” was not passed by URL, then the “if first.&control1 then do;” statement is not added to the code.

```
by &control1 &row &column ;
%if "&control1" ne "" %then %do;
    if first.&control1 then do;
%end;
%else %if "&control1" = "" %then %do;
   if &row = 0 and &column = 0 then do;
%end;
    rowstats = 0; ns = 0;
```

When reading the data, the application calculates the number of lines and fills in the corresponding arrays with precalculated values defined by the selected statistics.

```
rccount + 1 ;
 if "&SampleSize" = "on" then row_nsum[rccount] = nsum ;
 if "&WeightedSize" = "on" then row_wsum[rccount] = wsum ;
 if "&StdErrorWeightedSize" = "on" then row_sewgt[rccount] = sewgt ;
 if "&TotalPercentage" = "on" then row_totper[rccount] = totper ;
 if "&StdErrorTotalPercentage" = "on" then row_setot[rccount] = setot ;
 if "&RowPercentage" = "on" then row_rowper[rccount] = rowper ;
 if "&conf_inter_row" = "on" then do;
 row_lowrow[rccount] = lowrow;
 row_uprow[rccount] = uprow;
 end;
 if "&StdErrorRowPercentage" = "on" then row_serow[rccount] = serow ;
 if "&ColumnPercentage" = "on" then row_colper[rccount] = colper ;
 if "&conf_inter_col" = "on" then do;
  row_lowcol[rccount] = lowcol;
  row_upcol[rccount] = upcol;
 end;
 if "&StdErrorColumnPercentage" = "on" then row_secol[rccount] = secol ;
```

After completing all the calculations and loading the arrays, the data is sent to the web page by SAS/IntrNet. Below are some sample lines of the SAS code.

```
put '<center><table summary="This table shows a description of the crosstabulation
you have run." ><tr><th class=th_class align=left><b>Crosstabulation of: <br>';
put "ROW = &row_label by <br>" ;
put "COLUMN = &col_label <br>";
%if "&control1" ne ""  %then %do;
put "Controlling for :  &c1_label  = " &control1 " <br> ";
%end;
put "</b></th></tr></table></center><br>";
put "<tr>";
put '<th class=th_class align="center" scope="col" >';
put "&row_label" ;
put "</th>";
put '<th class=th_class align="center" scope="col">';
put "Statistic" ;
put "</th>";
put '<th class=th_class  scope="col" align="center">';
put &column ;
put "</th>";

if last.&row and rowstats = 0 then do;
rowstats = 1;
put '<th  class=th_class  scope="col">';
put "Row Total"
put "</th>";
put "</tr>";
end;
etc.,
```

Depending on the statistics the user selects (e.g., StdErrorTotalPercentage, RowPercentage, StdErrorRowPercentage, etc.), the program writes data from the arrays to the web pages.

```
if "&SampleSize" = "on" then do;
put '<td  scope = row align=center >n</td>' ;
do i = 1 to colcount ;
put '<td  align=center>' row_nsum[i] comma15.0'</td>'; end;
put '<td bgcolor = "#ffe0a7" align=center >' rowtot_nsum comma15.0 '</td></tr>';
end;
```

The results of all these data manipulations are displayed in a web report.

At this point, the user can choose to have results displayed in tabular or graphical format or/and saved as Microsoft Excel tables for additional manipulation. See Figure 4.

Below is the partial SAS code responsible for the selection options in Figure 5.

```
put '<A HREF="#" onClick="document.alphaform.submit();" title="Back To PONDER
Home">Back To PONDER Home</A></FORM>';
put '<FORM ACTION=broker.exe name="myform">';
put '<INPUT TYPE=HIDDEN NAME=_service'  " VALUE=&_service>";
put '<INPUT TYPE=HIDDEN NAME=_program'  " VALUE=PONDER_p.download_report.sas>";
put '<INPUT TYPE=HIDDEN NAME=save_rpt'  " VALUE=&nameoffile>";
put '<INPUT TYPE=HIDDEN NAME=save_dir'  " VALUE=&save_dir>";
put '<INPUT TYPE=HIDDEN NAME=contenttype'  " VALUE=text/x-comma-separated-values>";
put '<input type=hidden name="_debug"'  " VALUE=0>";
put '<A HREF="#" onClick="document.myform.submit();" title="Download To
Excel">Download To Excel Spreadsheet</A></FORM>';
 put '<A HREF="#"onClick="document.thirdform.submit();" title="Create
Graph">Graph</A>';
```

The value of the &graphotype macro variable could be "three_dim_hor_bar," "hor_bar," "three_dim_vert_bar," or "vert_bar," which is then passed to the SAS program by the URL.

```
sumvar =
 %if "&graph_stat" = "WeightedSize" %then %do;
 wsum
 %end;
Etc.,
```

Below is the part of the program that displays the graph on the web. After the SAS program creates the *.gif file, the graphic is passed and displayed on the web by the application broker. The symbols &sysdirurl, &mystats, and &mytime, which were created at execution time, are passed to the program by the application broker.

```
%if %sysfunc(fileexist(&myfile)) %then %do ;
  put '<center><table border="0"><tr><td>';
  put '<br><br><img
src="'"&sysdirurl.&_graphslocal.&mystats"'/'"&newtime"'/gchart'"&i"'.gif" alt="large
graph" width="720" longdesc="This is a large graph that visually shows the
results.">';
  put '</td></tr></table></center>';
%end;
```

CONCLUSION

Using dynamic SAS/IntrNet and SAS as the primary working tools, RTI developed PONDER, a web-based analytical tool, in a context-appropriate format for its PRAMS Project for CDC.

Overall, the system provides users with an easy-to-use, intuitive graphical interface. It also provides users with online instructions to help them through each step of their data analysis. Finally, the system produces tables and graphs in real time that users can save in various formats. Users can also save the data generated as Microsoft Excel files for further manipulation.

Using advances made in available technologies to seamlessly incorporate SAS, SAS/IntrNet, XHTML, HSQL, JavaScript, and SUDAAN, RTI created a tool with a user friendly interface that enables researchers and policymakers to easily and safely process data and view the results.

PONDER's analytical strength comes from combining SAS and RTI's SUDAAN. We believe that the groundwork laid here will be very useful in other projects. Combining SAS and SUDAAN gives PONDER the flexibility to respond quickly when new data becomes available annually, and to introduce new statistical techniques and additional complex data series as they become available.

REFERENCES

1. Henderson, Don. 2006. *Building Web Applications with SAS/IntrNet: A Guide to the Application*. Cary, NC: SAS Institute Inc.
2. Bednarski, Mary A., Clark, Karen A., Hornbeck, Elizabeth M., and Gordon, Mae O. 2002. "Dynamic Data Retrieval Using SAS/IntrNet." Proceedings of the Twenty Seventh Annual SAS Users Group International Conference, Orlando, FL, Paper 197-27 (p. 6).
3. Winn, Thomas J. 2006. "State Agency Personnel Information Reports: A SAS/IntrNet® Project." Proceedings of the Thirty First Annual SAS Users Group International Conference, San Francisco, CA, Paper 178-31 (p. 8).
4. Ranson, John and Chan, Wai Ming. 2004. "A Complex Query within SAS/IntrNet." Proceedings of the Twenty Ninth Annual SAS Users Group International Conference, Ottawa, Canada, Paper 022-29 (p. 9).

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