Data Warehousing and Information Delivery:
Success and Failure in Managed Care

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Abstract

This paper describes the use of the SAS System by a nationally recognized managed care organization to meet its information delivery needs. This paper is intended for managers and will detail the organization's struggle with the issues surrounding data warehousing and information delivery. The paper will highlight our successful use of the SAS System® to provide a full range of information delivery services. Specific areas of information delivery profiled will include data warehousing, decision support, reporting, data display, applications development and internet/web applications. Emphasis will be placed how we have been able to use the SAS System to leverage our investment in hardware, software and human resources to respond to demands for information delivery. The paper and presentation will include descriptions and demonstrations of work done in the areas outlined. SAS System products discussed will include Base SAS®, SAS/Graph®, SAS/AF®, SAS/EIS®, SAS/FSP®, SAS Warehouse Administrator®, SAS ODBC Drivers®, SAS/Access®, and SAS Intranet®.

Introduction

Health Services Medical Corporation (HSMC) is a health maintenance organization (HMO) servicing central New York and the Southern Tier of central New York. Our use of the SAS System dates back to 1988 when we first licensed the SAS System for personal computers. The Health Care Analysis Department began to do some basic reporting using large summary files provided by our MIS department. Prior to using the SAS System for personal computers most analysis was done using printed reports generated directly from on-line transaction processing systems (OLTP). Data from these reports was frequently keypunched to LOTUS spreadsheets for display and analysis. Using the SAS System was much more effective than manually transferring data to spreadsheets.

Recognizing the potential for enhanced information delivery using the SAS System we purchased a SUN Microsystems Sparcstation 1. In 1990 we licensed the SAS System for UNIX. SAS's multi-vendor architecture allowed us to easily move our data and SAS code from the personal computer to the UNIX workstation. The UNIX workstation provided significantly greater computing power and maximized the capability of the SAS System. With this enhanced capability we were to begin using larger detail data downloads.

Conceptual Framework for Decision Support and Information Delivery

Moving from being a small ad hoc reporting entity to a decision support and information delivery provider required us to adopt conceptual framework for our work. We refer to the work that we do in the context of the "Decision Support Life Cycle." This framework is shown in Figure 1. The "Decision Support Life Cycle" represents the full range of development for an information request. At one end of this range is the simple ad hoc report and at the other of the range is the interactive internet/web application. With the SAS Institute as a strategic partner we have been able to provide the full range of services in this continuum.

Data Management, Reporting and Data Display

Typically, a request for information begins as an ad hoc report requiring basic data extraction, summarization and report generation. Then we might see repeated requests for the same general report with minor changes in the report parameters. At this point in the life cycle of this request for information we would "macro" code the program used to generate the ad hoc report. Macro coding the program involves placing symbolic references in the code. The symbolic references are used to represent the changes in report parameters. Here the programmer only needs to change the report parameters one time in one location. For example, changing a date range for a report requires a parameter (date range) to be coded in part of the program where the data is extracted and also in the report title. Using macro code this change need only be done one time. While this might seem simplistic it can provide huge efficiencies in more lengthy and complicated reports. An example of this type of report is shown in Figure 2.

In this actual scenario we used Base SAS to manage the large volume of detail transaction data that goes into the report, generate the report and display the data and macro code the underlying program.

Recognizing that an information request may have a life cycle that ends with the ad hoc report we can generate such a report with minimal effort. For those reports that do have longer life cycles we can leverage the work done when creating the ad hoc report. In the example above we took an ad hoc report, macro coded the program, and then created a user-friendly front end so that our customers could request the report themselves.

Applications Development

Developing user-friendly front-end applications represents the next progressive step in the decision support life cycle. Figure 3 shows how we were able to take the Plan Experience Report from Figure 2 and incorporate it into an automated report generation application. Using SAS/AF we provide our customers a flexible way to create their own reports. Figure 3 is part of a series of screens in an application we developed to facilitate the delivery of information to our customers. Figures 3 displays an extensive range of parameters the customer may select in generating a report.

Data Distribution

Shortly after we developed our customer applications for generating reports we began to give data files to selected customers. Initially we produced ASCII files which our customers could import into worksheets and databases packages. This was very successful. Here, we could empower our more sophisticated customers with manageable information which they could in turn manipulate and display to their own liking. Since this initiative was so successful we acquired the SAS ODBC drivers which allowed us to create files which could be read directly by Microsoft Excel® and Microsoft Access®. Figure 4 shows a typical detail data file and a meta data file retrieved using the ODBC drivers for Microsoft Office.

An additional example leveraging our investment is our ability to incorporate the choice to download an ODBC file in place of a report in our customer application (see Figures 3).

Executive Information Systems (EIS)

Moving along the continuum represented in the "Decision Support Life Cycle" we find the Executive Information System (EIS). The EIS represents our response to a demand for a more graphic display of the data contained in the Plan Experience Report. The EIS is designed as a reference tool for senior staff. This EIS was developed using SAS/EIS software. Again we were able to use existing programs for the EIS and add the user interface with

SAS/EIS. Figure 5 shows an example of one of the screens in our EIS.

Web/Internet Applications

During the late 1997 and early 1998 information delivery customer base expanded outside the walls of our organization. In response to the need to deliver information to customers beyond our walls we began to make use of the world wide web and the internet. In early 1998 we began to deploy information to a web site as static reports. This was done by using just a few lines of code that we retrieved for the SAS Institute research and development web page. An example of our static web reporting capability appears in Figure 6 and Figure 7.

During the summer of 1998 we began developing interactive applications. This is what we consider a fully "articulated" information request. Here users can access our web site, specify parameters and request reports or data. An example of this interface is shown in Figure 8.

Data Warehouse

Over the last eight years we have developed an informal but effective data warehouse to support our information delivery infrastructure. In 1998 we purchased the SAS Warehouse Administrator and have been in the process of operationalizing the software. Figure 8 shows one of the windows from our implementation of the SAS Warehouse Administrator.

During the course of our development of an information delivery system there was an independent initiative in our MIS Department to develop a data warehouse. After approximately two years corporate support for this initiative was withdrawn. This is the "failure" part of the paper. Although there were several reasons for the failure of the data warehouse initiative in our MIS Department the most important reason was that the developers assumed that the relational model was most appropriate and that we needed to use one of the proprietary relational data base products. As a result the data in the data warehouse reflected administrative business processes (good for operational processing, bad for analysis) and not the general dimensions of the business. For example, when the MIS data warehouse team designed the medical claim section of the data warehouse it had 25 tables and the subscriber section had 13 tables. This design process was extremely difficult and took more than twelve months to complete. Even after 18 months of work and populating the subscriber section of the data warehouse there was little to show as a product.

This can be contrasted with the data warehouse in the Health Care Analysis Department, which has one table for claims and one table for subscribers. We have chosen to define our data warehouse more abstractly as a collection of met needs. Using this definition you do not have a data warehouse unless you have met or exceeded the information delivery needs of at least one customer. With this definition the technology is much less relevant. Delivering the product and services is the final measure of success.

Once support for the MIS data warehouse initiative was withdrawn, resources were redirected to the information delivery system in the Health Care Analysis department. While the MIS data warehouse initiative went poorly we learned a lot and I do not think that our experience is uncommon.

Conclusion

This paper has provided an overview of a successful information delivery system that has been developed incrementally over approximately eight years. The information delivery system profiled includes a wide array of applications. This paper gives managers an example of how a company can learn and succeed in its information delivery pursuits. With SAS Institute as our strategic partner we have been able to provide a full spectrum of information delivery products and services.

[R] SAS is a registered trademark of SAS Institute.
[R]Microsoft Excel and Microsoft Access are Microsoft Corporation products.
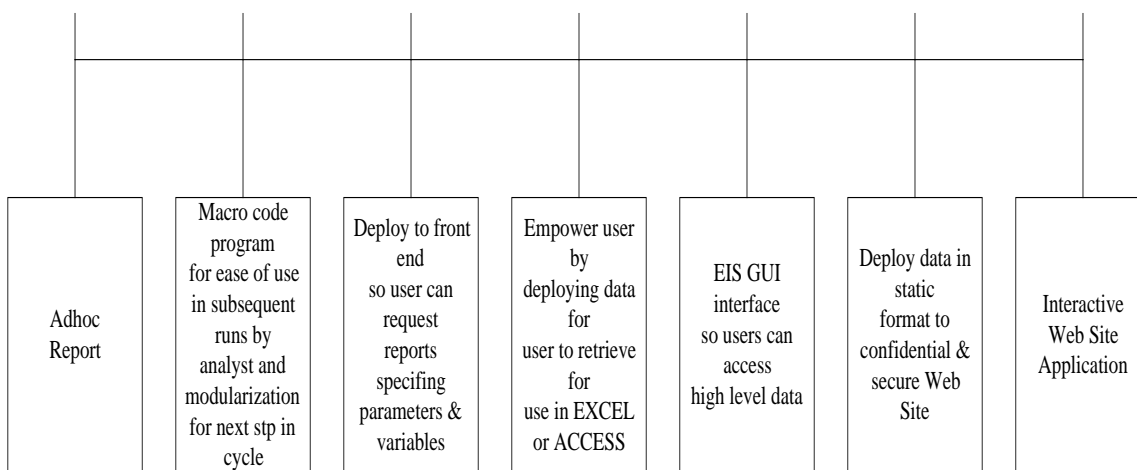
Figure 1

Figure 2

Sample "Plex" Report

HSMC - HEALTH CARE ANALYSIS DEPT 31DEC97
PLAN EXPERIENCE
LINE OF BUSINESS: PREPAID HEALTH PLAN
NETWORK: SAMPLE - PHO

01JAN97 THROUGH 31MAR97 - CUTOFF DATE 30NOV97

BILL TYPE ALL SERVICES		Number of Procedures	Amount Requested	Actual Payments *1	Simulated Payments *2	Total Amount Paid *3	Withhold Cost	Copay	Total Cost *4
A Professional Services	A1A Office Visits	11,374	$646,663	$465,983	$0	$465,983	$45,484	$77,181	$588,649
	A1B Inpatient Visits	533	$75,779	$46,381	$0	$46,381	$3,895	$155	$50,431
	A1C Emergency Room Visits	254	$33,185	$26,762	$0	$26,762	$1,436	$0	$28,198
	A1D Injections/Immunizations	2,364	$91,050	$60,958	$0	$60,958	$1,726	$293	$62,976
	A2 Laboratory	13,073	$411,104	$182,746	$23	$182,769	$7,155	$216	$190,140
	A3 X-Ray	2,546	$384,917	$188,169	$90	$188,259	$9,587	$71	$197,916
	A4 Physical Therapy	200	$12,003	$10,607	$0	$10,607	$2	$419	$11,027
	A5 Prosthetics/Appl./Suppls.	485	$81,290	$69,709	$0	$69,709	$374	$6,103	$76,186
	A6 Substance Abuse OP	0	$0	$0	$0	$0	$0	$0	$0
	TOTAL	41,030	$3,029,669	$1,709,202	$247	$1,709,449	$118,197	$119,704	$1,947,351
B1 Hospital Pool - Institutional Svcs	B1A Inpatient	223	$786,033	$211,805	$273,456	$485,261	$0	$3,400	$488,661
	B1B Outpatient Services	236	$301,497	$153,811	$0	$153,811	$0	$0	$153,811
	B1C Skilled Nursing Facility	1	$26,250	$26,250	$0	$26,250	$0	$0	$26,250
	TOTAL	460	$1,113,780	$391,866	$273,456	$665,323	$0	$3,400	$668,723
B2 Hospital Pool - Special Services	B2A Emergency Room	255	$100,969	$56,935	$0	$56,935	$0	$7,968	$64,903
	B2B Radiation Therapy	2	$909	$727	$0	$727	$0	$0	$727
	B2F Home Health Care	43	$45,453	$44,468	$0	$44,468	$0	$0	$44,468
	B2G Other Miscellaneous	52	$55,003	$33,487	$0	$33,487	$0	$675	$34,162
	TOTAL	409	$228,633	$160,334	$0	$160,334	$0	$8,643	$168,977
TOTAL ALL SERVICES		41,899	$4,372,083	$2,261,402	$273,704	$2,535,106	$118,197	$131,747	$2,785,050

*1: Simulated payments for capitated/contracted vendors excluded.
*2: Capitated/contracted vendors only. Amount paid is equal to the allowed amount (lesser of the fee schedule or requested amount) less copay.
*3: Total Cost to HSMC. Actual Payments + Simulated Payments
*4: Total Cost to HSMC and Patient. Total Amount Paid + Withhold Cost + Copay
Does not include DME and bad debt & charity.
stndplex (hmcca)

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Health Care Analysis Department

Figure 3

Figure 4

ODBC to Access: Meta & Detail
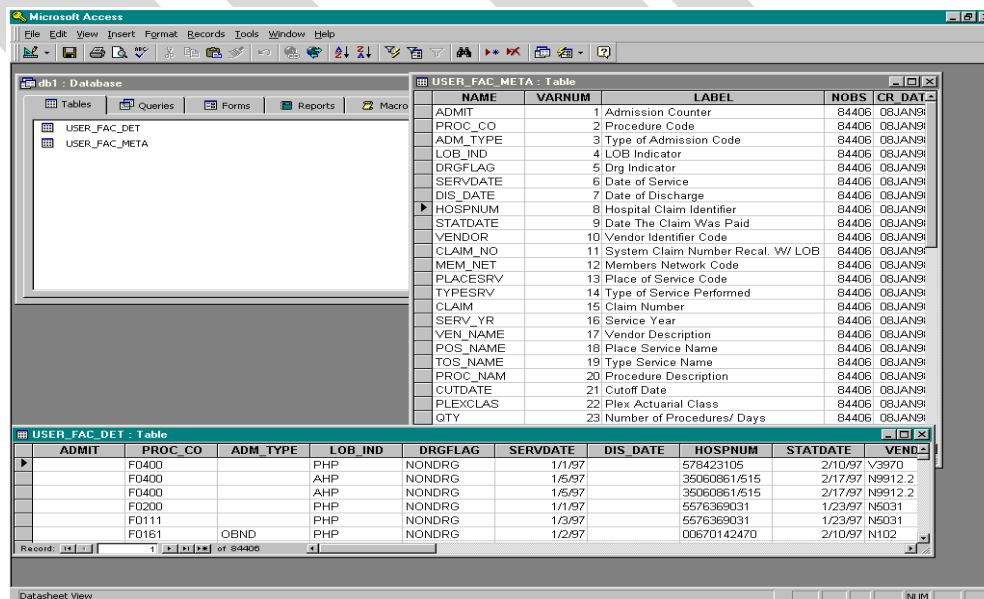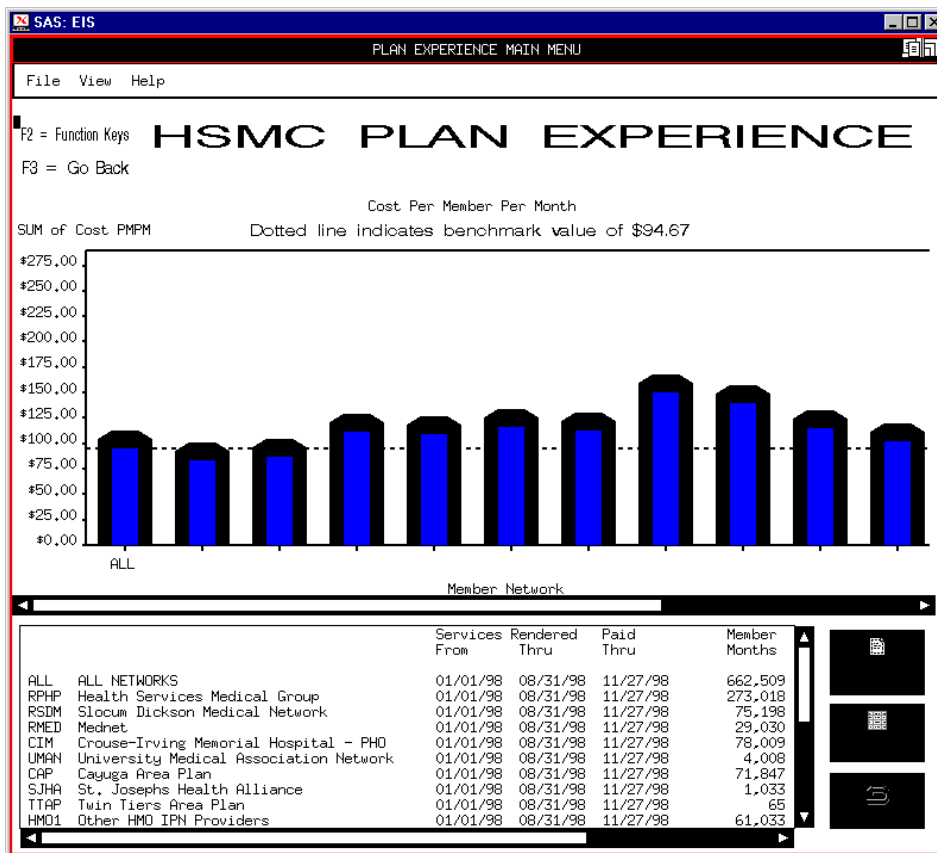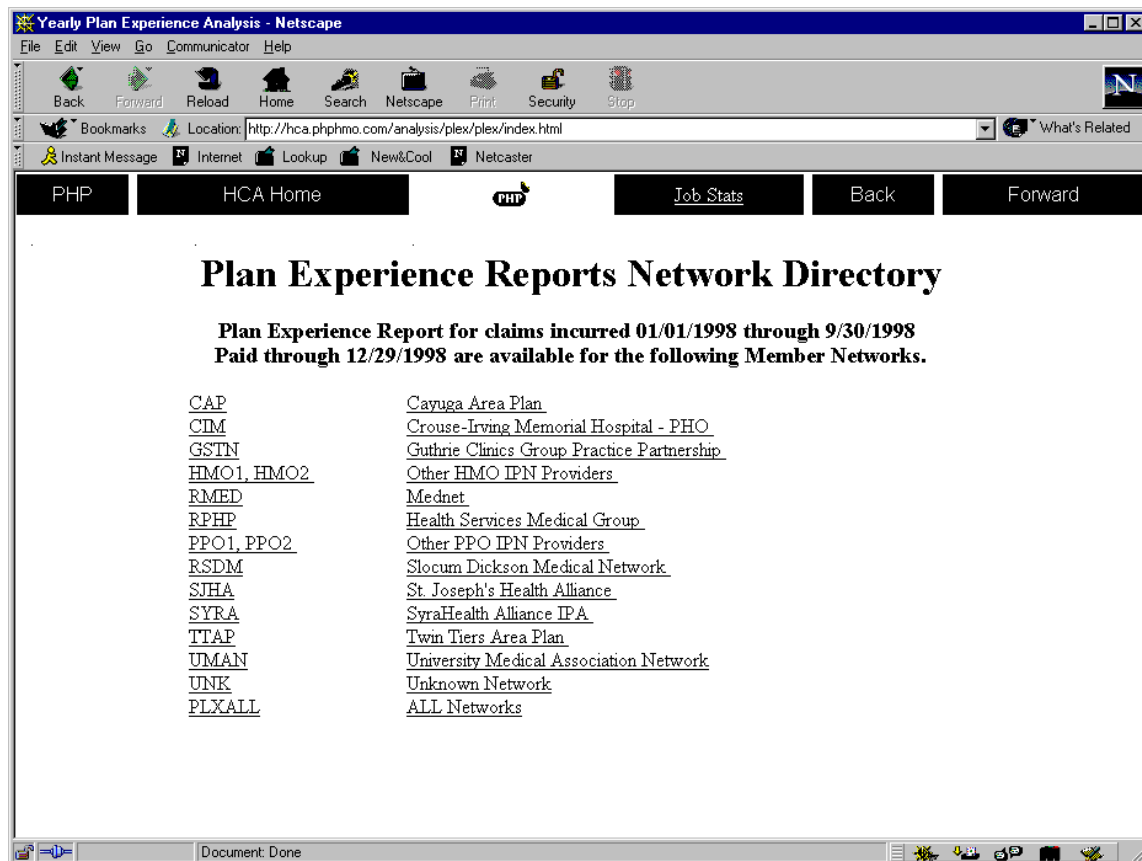

Health Services Medical Corporation
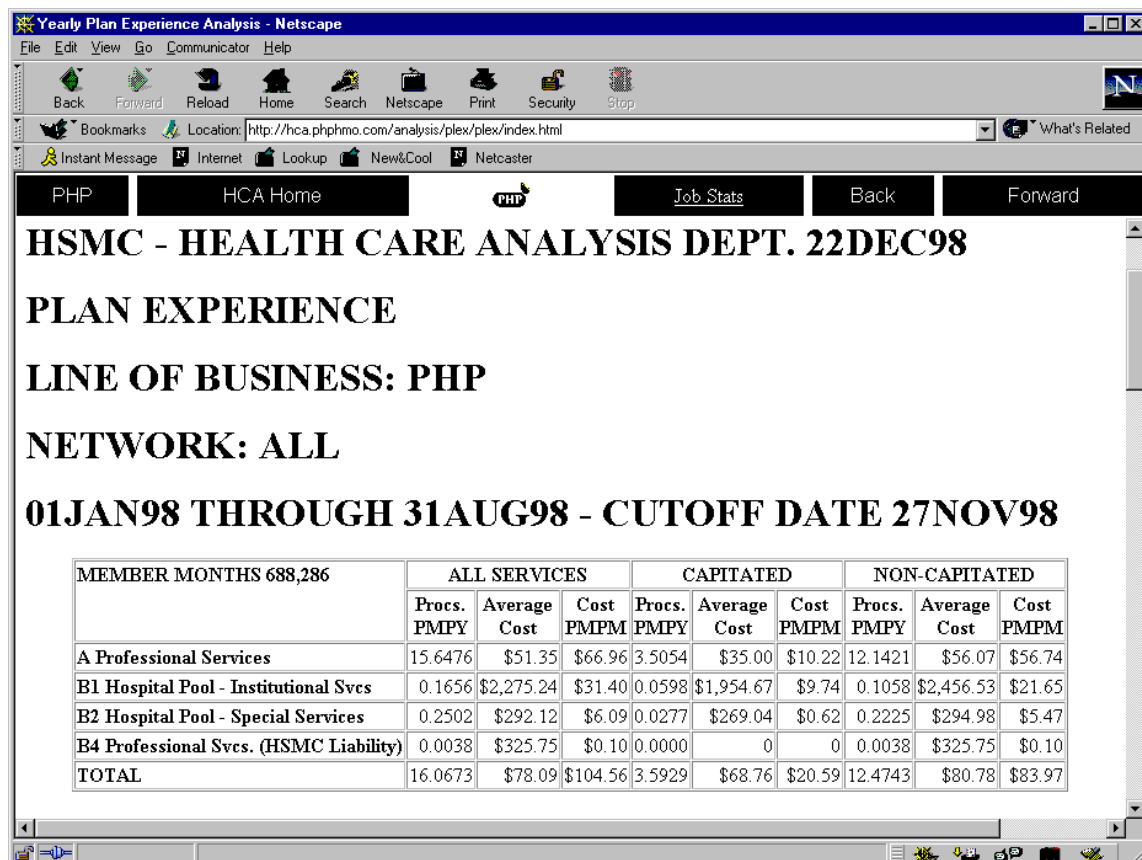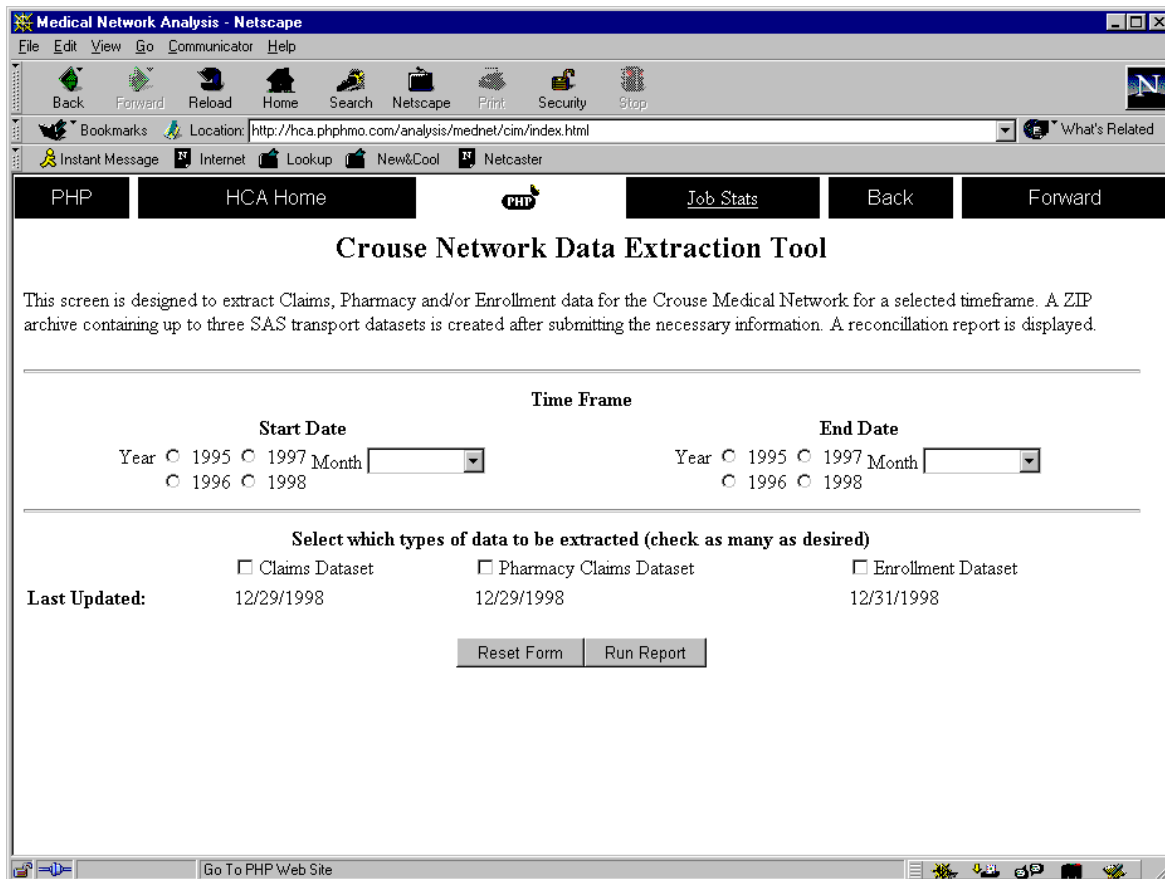Health Care Analysis Department

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9