CPDMS - A CLINICAL PHARMACOLOGY DATA MANAGEMENT SYSTEM

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Abstract

CPDMS, an interactive, menu driven computer system, was developed to eliminate the manual transcription of laboratory test results and facilitate the management of this data. Tools provided by National Health Laboratories (a Revlon, Incorporated subsidiary), Clists, and SAS have been integrated to create this system. Using a sequential file stored on the corporate IBM 3042, a SAS dataset is created and used to update the master SAS database. This master database provides up to the minute test results needed to prepare final case report form documents.

Introduction

Revlon is known world wide as a manufacturer of cosmetics and fragrances. Another major interest is in the field of health care. Revlon Health Care Group (RHCG) consists of USV Pharmaceutical Corporation, National Health Laboratories (NHL), and several other health related companies. This paper is concerned with two Revlon Health Care Group companies, USV and NHL.

Background

For the past several years, Revlon has placed a significant emphasis on the research and development of ethical pharmaceuticals. Towards this end the Center for Clinical Pharmacology (CCP) was established to assist in the evaluation of medicines used for the first time in man. Located in Westchester County, New York, this 23 bed self-contained modern pharmaceutical testing center is under the full time direction of a physician and staffed with clinical research nurses. The recruitment of healthy volunteers is the first step in this clinical research process.

The CCP generates large amounts of clinical data and utilizes the services of NHL to analyze blood and urine specimens. The analysis of these samples is a fully automated process. Results of hematological, blood chemistry, urinalysis, and other laboratory tests are keyed into an IBM 5280 data entry station at NHL's facilities. This data is transmitted, on a daily basis, to an IBM 3042 located at Revlon's Corporate Data Center.

In the past, no effort was made to automate the collection of this vast amount of laboratory data. Until recently, clinicians at the CCP only had viewing access to this data on an IBM terminal connected via modem to NHL's Series 1 computer, which accesses the corporate IBM 3042 data base. Hard copy of the laboratory test results was limited to the form that the laboratory sends to the physician, and this was not received until the following day. (See Figure 1.) The next steps were to manually transcribe this data onto case report forms and keyboard enter the data into RHCG's computerized Clinical Data Management System. The data was then telecomunicated to the IBM 3042 and a programmer would put the data into SAS.

Advances

With the development of CPDMS, we were able to eliminate the need for the IBM terminal and its direct connection to the IBM Series 1. A Hewlett Packard 2622P CRT with hardcopy, already located at the CCP and used for remote data entry into RHCG's computerized clinical data management system is used. Errors associated with the transcription of data as well as the data entry process were eliminated.

Key advantages of the HP 2622P terminal include:

- hard copy of screen to an integral printer;
- forward and backward scrolling through the display memory.

Neither of these features were available on the IBM terminal.

Rationale

By integrating tools provided by National Health Laboratories, IBM Clist, and SAS, this system offers end users, all computer naive, the ability to access their data and print final official documents in a variety of ways.

Tools

National Health Laboratories

Specimens are sent to NHL daily and within twenty-four hours their results are available for viewing. The computer

generated report (Figure 1) is sent to the CCP, by messenger, the following day. Data is stored on the IBM 3042 at the Revlon Corporate Data Center and is updated on a daily basis.

Clist and SAS

Using Clists to create a menu driven closed system where the user interacts with a master Clist which in turn interacts with SAS, ensures a greater degree of safety and efficiency.

Functional Aspects

Data acquisition is in the form of 153 byte sequential records. (See Figure 2.) Using the data mangement tools of SAS, it is possible to read the data, manipulate it into a meaningful form and create two SAS data sets.

The first data set consists of all subject demographic information, as well as the results from each laboratory test performed (See Figure 3). This corresponds directly to the sequential data set supplied by NHL. In this data set, each laboratory test for each day of testing is stored by subject and occupies one observation.

In order to further simplify the handling of the data, a second data set is created from the first. Using PROC TRANSPOSE, this data set has all the data for a particular subject and test on one observation. (See Figure 4.)

It is totally transparent to the users whether the data they review is in the SAS database or in the sequential dataset. As soon as the user executes the master Clist, the sequential dataset is opened and read. If no data is found in this sequential dataset, the Clist goes directly to the master menu where the various options are displayed. If the presence of data is detected, a SAS program is invoked which updates the SAS 'MASTER' database with the new sequential data. The updated data is then transposed and control goes to the master menu. This method guarantees all the data viewed or printed is completely up-to-date. Once a week a 'batch' SAS program is run which updates and transposes the new data which will in turn be the 'master' dataset for the next week's data.

A bonus of direct access to the NHL data on the IBM 3042 is the early creation of the SAS data base. This eliminates several weeks of waiting by a biometrician for data to be received, entered and transmitted to SAS.

The data base update, transpose, and management is handled weekly by a programmer analyst. The SAS routines have been tested and few problems have been identified.

Master Menu

In order to make this system easy to use, two 'soft keys' on the HP 2622P terminal are utilized for logging onto the IBM system and for executing the Clist. The user dials the system, hits two keys and is presented with a master menu which allows selection of any of seven different options (see Figure 5). These options include viewing data on the screen by name or date, printing the case report form documents by name or protocol, displaying normal ranges, and a 'help' file which gives general information about the system and its use.

After the user selects an option, a prompt to enter specific information is received. This might include a patient's name, protocol number, or date. If the information entered is in error (e.g. wrong format for date) an error message is displayed and the user is prompted to enter the correct information. Error checking is done using a Clist command file to prevent SAS errors form occurring later on. Once the correct information has been entered, the necessary datasets are allocated and SAS is invoked.

Viewing Data

In order to better monitor a medication's effect in the volunteer population, the physicisn and nurses need the ability view data from more than one day at the same time. They need the ability to compare results from previous days with those of the present and walk away with hard copy. Using option #1, it is possible to view data from four different dates for a subject. Previously, only data for a specific date could be accessed.

The second option, view data by date, allows the physicians and nurses to view all the data for a particular date, sequentially, regardless of how many subjects are involved.

Print Case Report Form Documents

Federal regulation requires all test results to be reported on a signed Case Report Form Document. With our previous system this meant a manual transcription from the NHL computer generated report. Since the data is in a SAS data base, it's advantageous to use the FILE PRINT option of SAS to print the CRF with the results of each test already filled in. The user identifies which name or protocol is required and a batch job is submitted for processing. We took this one step further. Making use of a Xerox 9700 laser printer at the Corporate Data Center, we have reduced the amount of paper from an average of six sheets, to a single page. (See Figure 6.) This document is not only more legible, but all results can be seen at once so there is no longer a need to "flip" between pages. The results are also "flagged", high or low, to indicate if they fall outside the normal range for each parameter. A list of normal ranges for each test day are also printed for easy reference. The elimination of data transcription errors, time and cost savings are probably the biggest benefits.

Conclusions

CPDMS is not only a time saver, but is indeed a cost saver, too. In summary, the following benefits have been achieved:

- Elimination of the need to transcribe the data from NHL computer generated sheets to CRF's. (Time and Cost saver)
- Elimination of the need to enter data into a local data base and then transmit it into SAS. It is already in SAS. (Time and Cost saver)
- CRF's are no longer printed by an outside concern. (Time and Cost saver)
- All data for a particular subject is on one sheet instead of six. (Time and Cost saver)
- Since all laboratory work is done by one laboratory, there is no longer any discrepancy in how a specific test is performed. (Time and Cost saver)
- Capability to review data in a more appropriate manner. (Time saver)
- Capability of hard copy output, at the terminal. (Time saver)
- Within hours of the sample being delivered to NHL, any terminal can access the results. (Time saver)
- The SAS data base is created at the start of a study instead of at the end. (Time saver)
- Elimination of the IBM terminal and data communications link to NHL. (Cost saver)

References

SAS User's Guide: Basics, 1982 Edition. SAS Institute Inc., Cary, NC

OS/VS2 TSO Command Language Reference. IBM Corp. (CC28-0646-4)

TSO Programmable Clists. Deltak Inc.

National Health Laboratories INCORPORATED

PATIENT

ACCESSION NO.

REQUESTED BY

AGE	SEX	COLLECTION DATE	ACCESSION DATE	REPORT DATE	ACCOUNT NO.	TELEPHONE NO.	ROUTE
	F	05/12/83	05/12/83	05/13/83			2

TEST NAME	WITHIN RANGE	OUTSIDE RANGE	REFERENCE RANGE	UNITS
SPECIAL PROFILE - 0961				
COMPLETE BLOOD COUNT				
WHITE BLOOD COUNT	7.5		3.9 - 10.9	THOUS/CU.
RED BLOOD COUNT	5.22		MALE: 4.20 - 5.90 FEMALE: 3.70 - 5.30	MILL./CU.
HEMOGLOBIN	16.2		MALE: 13.0 - 17.8 FEMALE: 11.0 - 16.0	GM/DL
HEMATOCRIT	51.7		MALE: 36.5 - 52.0 FEMALE: 33.0 - 47.0	VOL%
MCV		99. HI	77 - 97	FL
MCH	31.0		27.0 - 35.0	PG
MCHC	31.3		31.0 - 37.0	GM/DL
POLYS	53.		47 - 75	%
LYMPH	38.		18 - 46	%
MONO	7.		2 - 11	%
EOSIN	1.		0 - 6	%
BASO	1.		0 - 2	%
URINALYSIS - ROUTINE				
COLOR	YELLOW			
SPECIFIC GRAVITY	1.028		1.003 - 1.030	
APPEARANCE	CLEAR			
REACTION	ACID			
ALBUMIN	NEGATIVE		NEGATIVE	
GLUCOSE	NEGATIVE		NEGATIVE	
ACETONE	NEGATIVE		NEGATIVE	
BILE	NEGATIVE		NEGATIVE	
WBC/HPF	NONE SEEN			
RBC/HPF	NONE SEEN			
CASTS	NONE SEEN			
CRYSTALS	OCC AMORPH URATES			
EPITH CELLS	3+			
OCCULT BLD.-URINE	NEGATIVE		NEGATIVE	
PLATELET COUNT	226,000		150,000 - 500,000	CU.MM.
DRUG SCREEN				
VDRL	NON REACTIVE		NON-REACTIVE	
W/QUANT.IF REACTIVE	NOT INDICATED			

See important information on reverse side

Interpretation of test results should be considered in the light of age and sex of patient, together with any medications the patient is using.

"PERFORMED AT"
1007 ELECTRIC
VIENNA VA

Laboratory Director and Pathologist

Figure 1

```
H53817500001489000SMITH JOHN            S  D109 I21  MZ1010984    91400000-00/SCR
T53817500001489000                       1      I210961  SPECIAL PROFILE - 0961
T53817500011489000                       1      I210500  COMPLETE BLOOD COUNT
T53817505021489000          5.3          2      I210521    WHITE BLOOD COUNT          3.9 - 10.9                                          THO
T53817505031489000         5.16          2      I210512    RED BLOOD COUNT            MALE: 4.20 - 6.10    FEMALE: 3.70 - 5.50    MIL
T53A17505041489000         15.0          2      I210508    HEMOGLOBIN                 MALE: 13.0 - 18.2    FEMALE: 11.0 - 16.3    GM/
T53817505051489000         46.0          2      I210503    HEMATOCRIT                 MALE: 36.5 - 52.0    FEMALE: 33.0 - 47.0    VOL
T53817505061489000           89          2      I216063    MCV                        77 - 97                                             FL
T53817505071489000         29.0          2      I210065    MCH                        27.0 - 35.0                                         PG
T53817505081489000         32.6          2      I210064    MCHC                       31.0 - 37.0                                         GM/
T53817505091489000           60          2      I216806    POLYS                      47 - 75                                             %
T53817505111489000           29          2      I210071    LYMPH                      18 - 46                                             %
T53817505121489000            4          2      I210072    MONO                       2 - 11                                              %
T53817505131489000            6          2      I210073    EOSIN                      0 - 6                                               %
T53817505141489000            1          2      I210074    BASO                       0 - 2                                               %
T53817506001489000                       1      I210400  URINALYSIS - ROUTINE
T53817506011489000 YELLOW                2      I210401    COLOR
T53817506021489000        1.024          2      I210403    SPECIFIC GRAVITY           1.003 - 1.030
T53817506031489000 CLEAR                 2      I210402    APPEARANCE
T53817506041489000 ACID                  2      I210404    REACTION
T53817506051489000 NEGATIVE              2      I210405    ALBUMIN                    NEGATIVE
T53817506061489000 NEGATIVE              2      I210406    GLUCOSE                    NEGATIVE
T53817506071489000 NEGATIVE              2      I210407    ACETONE                    NEGATIVE
T53817506081489000 NEGATIVE              2      I210408    BILE                       NEGATIVE
T53817506091489000            1          2      I210085    WBC/HPF                    0 - 2
T53817506101489000            1          2      I210086    RBC/HPF                    0 - 1
T53817506111489000    NONE SEEN          2      I210092    CASTS
T53817506121489000 OCC AMORPH URATES     2      I210080    CRYSTALS
T53817506131489000 1+                    2      I210087    EPITH CELLS
T53817506151489000 NEGATIVE              2      I210421    OCCULT BLD.-URINE          NEGATIVE
T53817515291489000  244,000              2      I210530  PLATELET COUNT               150,000 - 500,000                                   CU.
T53817563791489000                       1      I215380  DRUG SCREEN
T53817580001489000          NON REACTIVE 2      I210616  VDRL                       NON-REACTIVE
T53817580011489000        NOT INDICATED  2      I210619    W/QUANT.IF REACTIVE
T53817511821489000     TEST IN PROGRESS         I210183  G&PD                       NORMAL
T53817563931489000     TEST IN PROGRESS         I215392  DRUGS DETECTED
T53817564781489000                       1      I210351  HBS,AG W/CONFIRMATION
T53817564771489000     TEST IN PROGRESS         I215637  HBS.AG                     NEGATIVE
T53817564781489000     TEST IN PROGRESS         I215478  HBS,AG CONFIRMATION
T53817590001489000                       1      I210999  SMAC PROFILE
T53817590011489000     TEST IN PROGRESS         I217174    GLUCOSE                  65 - 115                                            MG/
T53817590021489000     TEST IN PROGRESS         I217106    BLOOD UREA NITROGEN      7 - 23                                              MG/
T53817590031489000     TEST IN PROGRESS         I217153    CREATININE               0.6 - 1.5                                           MG/
T53817590041489000     TEST IN PROGRESS         I217337    URIC ACID                M: 2.5 - 8.0          F: 2.5 - 6.8                  MG/
T53817590091489000     TEST IN PROGRESS         I217306    TOTAL PROTEIN            6.0-8.0                                             G/D
T53817590101489000     TEST IN PROGRESS         I217053    ALBUMIN                  3.5-5.0                                             G/D
T53817590111489000     TEST IN PROGRESS         I217100    GLOBULIN                 2.1 - 3.5                                           G/D
T53817590121489000     TEST IN PROGRESS         I217101    A/G RATIO                0.9 - 2.1
T53817590131489000     TEST IN PROGRESS         I217115    CALCIUM TOTAL            8.5-11.0                                            MG/
T53817590141489000     TEST IN PROGRESS         I217297    PHOSPHORUS TOTAL         2.4 - 4.5                                           MG/
T53817590151489000     TEST IN PROGRESS         I217132    CHOLESTEROL TOTAL        129 - 302                                           MG/
T53817590161489000     TEST IN PROGRESS         I217334    TRIGLYCERIDES            30 - 150                                            MG/
T53817590171489000     TEST IN PROGRESS         I217294    ALKALINE PHOSPHATASE     31 - 125                                            U/L
T53817590181489000     TEST IN PROGRESS         I217330    SGOT                     5 - 35                                              U/L
T53817590191489000     TEST IN PROGRESS         I217335    SGPT                     0 - 45                                              U/L
T53817590201489000     TEST IN PROGRESS         I217261    LACTIC DEHYDROGENASE     92 - 252                                            U/L
T53817590211489000     TEST IN PROGRESS         I217103    BILIRUBIN TOTAL          0.2 - 1.5                                           MG/
T53817590251489000     TEST IN PROGRESS         I217300    POTASSIUM                3.3 - 5.3                                           MEQ
T53817590261489000     TEST IN PROGRESS         I217129    CHLORIDE                 98 - 111                                            MEQ
T53817590271489000     TEST IN PROGRESS         I217121    CARBON DIOXIDE           24 - 32                                             MEQ
T53817590281489000     TEST IN PROGRESS         I217318    SODIUM                   136 - 148                                           MEQ
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Figure 2

SAS

OBS	CHECK	TYPE	SUBJNUM	NAME	TESTDTE	SEX	AGE	MM	DD	YY	COMMENT	PROT	STDAY	PATNO	DATE
27	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
28	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
29	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
30	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
31	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
32	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
33	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
34	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
35	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
36	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
37	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
38	19	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
39	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
40	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
41	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
42	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
43	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
44	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
45	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
46	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
47	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
48	19	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
49	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
50	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
51	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796
52	4	T	600665	SMITH JOHN	131	M		1	31	84	99999-99/SCR/999	99999-99	SCR	999	8796

OBS	TSTSEQ	RESULT	ABNFLAG	TESTNUM	TSTDESCR	MVAL	UNTMEAS	T
27	9017	80		294	ALKALINE PHOSPHATASE	31 - 125	U/L	1
28	9014	3.1		297	PHOSPHORUS TOTAL	2.4 - 4.5	MG/DL	1
29	9025	4.8		300	POTASSIUM	3.3 - 5.3	MEQ/L	1
30	9009	7.0		306	TOTAL PROTEIN	6.0-8.0	G/DL	1
31	9028	144		318	SODIUM	136 - 148	MEQ/L	1
32	9018	25		330	SGOT	5 - 35	U/L	1
33	9019	28		333	SGPT	0 - 45	U/L	1
34	9016	140		334	TRIGLYCERIDES	30 - 150	MG/DL	1
35	9008	4.5		337	URIC ACID	M: 2.5 - 8.0	MG/DL	1
36	6476			351	HBS.AG W/CONFIRMATION			1
37	6379			380	DRUG SCREEN			1
38	6393	NONE DETECTED		392	DRUGS DETECTED			1
39	600			400	URINALYSIS - ROUTINE			1
40	601	YELLOW		401	COLOR			1
41	603	HAZY		402	APPEARANCE			1
42	602	1.033	HI	403	SPECIFIC GRAVITY	1.003 - 1.030		1
43	604	ALKALINE		404	REACTION			1
44	605	NEGATIVE		405	ALBUMIN	NEGATIVE		1
45	606	NEGATIVE		406	GLUCOSE	NEGATIVE		1
46	607	NEGATIVE		407	ACETONE	NEGATIVE		1
47	615	NEGATIVE		421	OCCULT BLD.-URINE	NEGATIVE		1
48	6478	NOT NECESSARY		478	HBS.AG CONFIRMATION			1
49	501			500	COMPLETE BLOOD COUNT			1
50	505	46.7		503	HEMATOCRIT	MALE: 36.5 - 52.0	VOL%	1
51	504	15.5		506	HEMOGLOBIN	MALE: 13.0 - 18.2	GM/DL	1
52	503	4.90		512	RED BLOOD COUNT	MALE: 4.20 - 6.10	MILL./CU.MM	1

Figure 3

SAS

OBS	NAME	NUM	T	N	TEST	CMAX	V1	V2
1	SMITH JOHN	1	1	107	WBC (THOUS/CU.MM)	2	4.6	7.0
2	SMITH JOHN	2	1	111	RBC (MILL./CU.MM)	2	4.90	5.50
3	SMITH JOHN	3	1	100	HGB (GM/DL)	2	15.5	17.6
4	SMITH JOHN	4	1	104	HCT (VOL%)	2	46.7	55.5
5	SMITH JOHN	5	1	148	MCV (FL)	2	95	101
6	SMITH JOHN	6	1	151	MCG (PG)	2	31.6	32.0
7	SMITH JOHN	7	1	154	MCHC (GM/DL)	2	33.2	31.7
8	SMITH JOHN	8	1	196	POLY (%)	2	40	48
9	SMITH JOHN	9	1	173	LYMPH (%)	2	52	44
10	SMITH JOHN	10	1	169	MONO (%)	2	7	5
11	SMITH JOHN	11	1	161	EOSIN (%)	2	1	2
12	SMITH JOHN	12	1	116	PLAT (CU.MM.)	2	227,000	278,000
13	SMITH JOHN	17	1	557	SPGR	2	1.033	1.030
14	SMITH JOHN	18	1	552	UAPEAR	2	HAZY	OPAQUE
15	SMITH JOHN	19	1	554	UREAC	2	ALKALINE	ACID
16	SMITH JOHN	20	1	583	UALB	2	NEGATIVE	NEGATIVE
17	SMITH JOHN	21	1	574	UGLUC	2	NEGATIVE	NEGATIVE
18	SMITH JOHN	22	1	577	UACE	2	NEGATIVE	NEGATIVE
19	SMITH JOHN	23	1	575	BILE	2	NEGATIVE	
20	SMITH JOHN	24	1	635	RBC/HPF	2	NONE SEEN	NONE SEEN
21	SMITH JOHN	25	1	631	WBC/HPF	2	NONE SEEN	NONE SEEN
22	SMITH JOHN	26	1	637	UCSTS	2	NONE SEEN	NONE SEEN
23	SMITH JOHN	27	1	657	UCRYS	2	MOD AMORPH PHOSPHATES	MANY AMORPH URATES
24	SMITH JOHN	28	1	731	OCCBLD	2	NEGATIVE	NEGATIVE
25	SMITH JOHN	29	1	653	UEPITH	2	2+	2+
26	SMITH JOHN	31	1	300	BUN (MG/DL)	2	17	15

OBS	V3	V4	F1	F2	F3	F4	D1	D2	D3	D4	S1	S2	S3	S4	SEX	AGE	PROT	PATNO	INITALS
1							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
2							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
3							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
4				HI			8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
5				HI			8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
6							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
7							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
8			LO				8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
9			HI				8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
10							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
11							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
12							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
13			HI				8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
14							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
15							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
16							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
17							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
18							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
19							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
20							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
21							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
22							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
23							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
24							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
25							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S
26							8796	BB14	.	.	SCR	DSC			M	19	99999-99	999	J S

Figure 4

```
**********************************************************************************

                    RHCG - NHL DATA ACQUISITION
                    ====   ====================


                    1. VIEW DATA ON SCREEN - BY NAME

                    2. VIEW DATA ON SCREEN - BY DATE

                    3. VIEW NORMAL RANGES

                    4. PRINT CASE REPORT FORM - BY NAME

                    5. PRINT CASE REPORT FORM - BY PROTOCOL

                    6. HELP

                    7. LOGOFF

**********************************************************************************

                              ENTER OPTION ==>
```

Figure 5

INVESTIGATOR"S SIGNATURE _____ DATE OF SIGNATURE _____

PROTOCOL #: 99999-99 SUBJECT #: 999 INITALS: J S AGE: 19 SEX: M

TEST	SCR 01/31/84	DSC 02/18/84
=== HEMATOLOGY ===		
WBC (THOUS/CU.MM)	4.6	7.8
RBC (MILL./CU.MM)	4.90	5.50
HGB (GM/DL)	15.5	17.6
HCT (VOL%)	46.7	55.5 HI
MCV (FL)	95	101 HI
MCG (PG)	31.6	32.0
MCHC (GM/DL)	33.2	31.7
POLY (%)	40 LO	48
LYMPH (%)	52 HI	44
MONO (%)	7	5
EOSIN (%)	1	2
PLAT (CU.MM.)	227,000	278,000
=== URINALYSIS ===		
SPGR	1.033 HI	1.030
UAPEAR	HAZY	OPAQUE
UREAC	ALKALINE	ACID
UALB	NEGATIVE	NEGATIVE
UGLUC	NEGATIVE	NEGATIVE
UACE	NEGATIVE	NEGATIVE
BILE	NEGATIVE	
RBC/HPF	NONE SEEN	NONE SEEN
WBC/HPF	NONE SEEN	NONE SEEN
UCSTS	NONE SEEN	NONE SEEN
UCRYS	MOD AMORPH PHOSPHATES	MANY AMORPH URATES
OCCBLD	NEGATIVE	NEGATIVE
UEPITH	2+	2+
=== BLOOD CHEMISTRY ===		
BUN (MG/DL)	17	15
URIC (MG/DL)	4.5	4.6
ALB (G/DL)	4.4	4.2
PHOS (MG/DL)	3.1	4.1
TRIG (MG/DL)	140	149
SGOT (U/L)	25	15
LDH (U/L)	174	125
K (MEQ/L)	4.6	4.7
CO2 (MEQ/L)	29	25
NA (MEQ/L)	144	142
GLUC (MG/DL)	79	82
CREAT (MG/DL)	1.3	1.1
TPROT (G/DL)	7.0	6.8
CA (MG/DL)	9.0	9.2
CHOL (MG/DL)	140	158
ALKP (U/L)	80	79
SGPT (U/L)	28	15
TBILI (MG/DL)	0.4	0.4
CL (MEQ/L)	104	105
=== SPECIAL TESTS ===		
G6PD	NORMAL	
HBSAG	NEGATIVE	
DRUGS	NONE DETECTED	
VDRL	NON REACTIVE	
VDRLQT	NOT INDICATED	

Figure 6