



RESOURCE AND PATIENT MANAGEMENT SYSTEM

Laboratory Reference (LR)

Laboratorian Guide

Version 5.2 Patch 26
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1.0 Introduction

IHS Lab Patch 26 incorporates changes and/or enhancements to the IHS Lab Package that have either corrected issues that had arisen or implemented requests.

This guide provides IHS Laboratorians with descriptions of the changes and/or enhancements and other information.

2.0 Lab Test File Modified To Prevent Infinite Recursion

It is currently possible to enter a Cosmic Test (i.e., a "panel" with several other tests within it) as one of its own panel of Atomic (single) tests in the Lab Test file. If the test is then used, infinite recursion may occur that could result in millions of transactions being generated by the Lab to PCC daemon.

The Lab Test file will be modified during the post install phase of Patch 26 to ensure that a Cosmic test cannot have itself as one of its own panel of Atomic tests.

2.1 Post Install Example

The only message regarding this change will be during the post install phase. It will appear on screen, looking similar to the following:

```
Changing Input Transform of .01 sub-field of 60.02 field of File # 60.  
.01 sub-field of 60.02 field of File # 60 changed. OK.
```

Figure 2-1: Post Install Lab File # 60 modification Example 1

2.2 Example of New Functionality

If a Lab Test is a Cosmic test, the message that is displayed when a user tries to enter the Cosmic test as one of the Atomic tests in the panel should be similar to the following (the message is bolded):

```
Select OPTION: ENTER OR EDIT FILE ENTRIES  
  
INPUT TO WHAT FILE: LABORATORY TEST//  
EDIT WHICH FIELD: ALL// LAB TEST INCLUDED IN PANEL      (multiple)  
  EDIT WHICH LAB TEST INCLUDED IN PANEL SUB-FIELD: ALL//  
THEN EDIT FIELD:  
  
Select LABORATORY TEST NAME: CHEM 7  
Select LAB TEST: ANION GAP// CHEM 7  
NO CAN DO ??  
Select LAB TEST: ANION GAP//
```

Figure 2-2: New functionality example

2.3 The Lab Test File's Input Transform Modified

The Input Transform of the .01 sub-field of the 60.02 field will be modified during the post install phase.

3.0 Accession File "C" Index

Sites may use a special routine that will delete "orphan" Accession file (# 68) pointers as well as producing reports regarding the Accession file's "C" Index after Patch 1026 has been installed.

3.1 Brief Background

The "C" index of the Accession file is the UID index for that file.

There is an issue, however, when a site uses the Supervisor's Menu option, "Purge old orders & accessions," in that the "C" index is not purged properly. Even though Accessions are purged from the Accession file, the "C" index does not reflect the purge, which means the "C" index can grow indefinitely. As it grows, response time degrades due to the sheer number of records the system has to search.

3.1.1 Orphan Entries

The entries in the "C" index that no longer point to valid entries in the Accession file itself are "orphaned" by the purging of the original accessions.

3.1.2 Do Not Re-Index Accession File

Because some of the Accession file's indexes are hard set by various Laboratory Cumulative Report routines, using FileMan to Re-Index the entire Accession file may cause the Cumulative Reports to reset to zero and thus no longer reflect current status, but will print all data for all patients. This could result in Cumulative reports being hundreds of pages long. This is an irrecoverable change.

3.2 BLRCINDEX

The BLRCINDEX routine is a stand-alone routine that will report on information regarding the Accession file's "C" index as well as allowing the deletion of all orphaned entries. It is in the IHS Lab namespace, BLR, and CINDEX stands for "C INDEX."

3.2.1 Site Manager Runs Routine

This routine should be run only by the site manager since it must be run in programmer mode:

```
D ^BLRCINDX.
```

Figure 3-1: Running the BLRCINDX routine

3.2.2 Main Menu

The “main menu” of the BLRCINDX will look similar to the following:

```

                                DEMO HOSPITAL
Date:01/09/09                IHS Lab Accession File                Time:9:04 AM
                                "C" Index Routines                BLRCINDX
-----
 1   Delete "Orphan" Entries
 2   "C" Index Report
 3   "Orphan" Entries Report
Select: (1-2):
```

Figure 3-2: BLRCINDX menu

3.2.3 Delete "Orphan" Entries

The selection of the Delete “Orphan” Entries option will call a subroutine that will:

- 1) Disable journaling
- 2) Go through the Accession file's “C” Index
- 3) Deletes all "orphan" entries it finds
- 4) Turns journaling back on when complete.

Every entry is checked and if it is an "Orphan" entry, it is deleted from the “C” index.

As a way of informing the user that it is working, the routine will, at every 1000th entry, display a “.” for a valid entry, but a “*” when the entry is an “Orphan.”

Note: For some sites, the number of orphan pointers can be in the 100's of thousands.

If the option is selected, the output may look similar to the following:

```

                                DEMO HOSPITAL
Date:01/09/09                IHS Lab Accession File                Time:9:51 AM
                                "C" Index "Orphan" Deletion        BLRCINDX
-----
Journalling stopped for this process only.

Deleting "Orphan" Pointers in Accession File's "C" Index
*****
***** .....*****
***** .....*****
***** .....*****
* .....
* .....*****
***** .....*.....

Journalling restarted.

Number of Pointers in "C" Index = 450096
Number of "Orphan" Pointers deleted from "C" Index = 305628

Press RETURN Key:

```

Figure 3-3: Delete "Orphan" Entries Example

3.2.4 "C" Index Report Menu

If the "C" Index Report option is selected, the routine first compiles information. At every 1000 entries, the routine displays a "*" if the entry is an invalid accession pointer and a "." if the entry is valid. The compilation of data can take several minutes, depending upon the number of entries in the Accession file's "C" index.

DEMO HOSPITAL						
Date:01/09/09		IHS Lab Accession File		Time:10:46 AM		
"C" Index Reports						
YEAR	LRAA	Accession Description	# Accs	# Orphans		
1999	1	HEMATOLOGY	5476	5476		
1999	2	EKTACHEM	6332	6332		
1999	4	MICROBIOLOGY	120	1		
1999	5	URINALYSIS	3633	3633		
1999	6	IMMUNOLOGY	4267	34		
1999	7	TOXICOLOGY	300	300		
1999	8	SEND OUT	1322	29		
1999	10	MANUAL	1060	1060		
1999	11	URINE MICRO	3406	3406		
1999	13	ESR	242	242		
1999	15	BLOOD BANK	175	175		
2000	1	HEMATOLOGY	8574	8574		
2000	2	EKTACHEM	10405	10405		
2000	4	MICROBIOLOGY	223	2		
2000	5	URINALYSIS	5463	5463		
2000	6	IMMUNOLOGY	6626	63		
2000	7	TOXICOLOGY	354	354		
Col>		1 <PFl>H=Help <PFl>E=Exit	Line>	18 of 131	Screen>	1 of 8

Figure 3-6: Browser Report Example

Once the user exits the Browser, the totals will display, similar to the following:

DEMO HOSPITAL		
Date:01/09/09	IHS Lab Accession File	Time:10:46 AM
"C" Index Reports		
	# Accs	# Orphans

TOTAL	450096	305628
Press RETURN Key:		

Figure 3-7: Browser Report Totals

3.2.4.2 Print "C" Index Report

If the user elects to print the "C" index report, either to a printer or to the screen, the report will look similar to the following:

DEMO HOSPITAL			Page 1	
Date:01/09/09	IHS Lab Accession File			
Time:1:06 PM	"C" Index Report			
YEAR	LRAA	Accession Description	# Accs	# Orphans
1999	1	HEMATOLOGY	5476	5476
1999	2	EKTACHEM	6332	6332
1999	4	MICROBIOLOGY	120	1
1999	5	URINALYSIS	3633	3633
1999	6	IMMUNOLOGY	4267	34
1999	7	TOXICOLOGY	300	300
1999	8	SEND OUT	1322	29
1999	10	MANUAL	1060	1060
1999	11	URINE MICRO	3406	3406
1999	13	ESR	242	242
1999	15	BLOOD BANK	175	175
2000	1	HEMATOLOGY	8574	8574
2000	2	EKTACHEM	10405	10405
2000	4	MICROBIOLOGY	223	2
2000	5	URINALYSIS	5463	5463
2000	6	IMMUNOLOGY	6626	63
2000	7	TOXICOLOGY	354	354
2000	8	SEND OUT	2201	77
2000	9	ANMC BLOODBANK	2	
2000	10	MANUAL	1637	1637
2000	11	URINE MICRO	5087	5087
2000	13	ESR	476	476
2000	15	BLOOD BANK	243	243
2001	1	HEMATOLOGY	8939	8939
2001	2	EKTACHEM	10985	10985
2001	4	MICROBIOLOGY	245	4
2001	5	URINALYSIS	5401	5401
2001	6	IMMUNOLOGY	6673	76
2001	7	TOXICOLOGY	436	436
2001	8	SEND OUT	2461	79
2001	9	ANMC BLOODBANK	1	
2001	10	MANUAL	1826	1826
2001	11	URINE MICRO	5032	5032
2001	13	ESR	589	589
2001	15	BLOOD BANK	272	272
2002	1	HEMATOLOGY	9323	9323
2002	2	EKTACHEM	12555	12555
2002	4	MICROBIOLOGY	432	31
2002	5	URINALYSIS	5756	5756
2002	6	IMMUNOLOGY	8461	90
2002	7	TOXICOLOGY	358	358
2002	8	SEND OUT	3453	136
2002	9	ANMC BLOODBANK	3	2
2002	10	MANUAL	2015	2015
2002	11	URINE MICRO	4567	4567
2002	13	ESR	529	529
2002	15	BLOOD BANK	82	82

2003 1	HEMATOLOGY	10184	10184
2003 2	EKTACHEM	11360	11360
2003 4	MICROBIOLOGY	848	49
2003 5	URINALYSIS	5439	5439
2003 6	IMMUNOLOGY	8364	88
2003 7	TOXICOLOGY	304	304
2003 8	SEND OUT	2495	101
2003 9	ANMC BLOODBANK	1	1
2003 10	MANUAL	2257	2257
2003 11	URINE MICRO	1	1
2003 13	ESR	393	393
2003 15	BLOOD BANK	13	13
2004 1	HEMATOLOGY	10865	10865
2004 2	EKTACHEM	12216	12216
2004 4	MICROBIOLOGY	3984	46
2004 5	URINALYSIS	4331	4331
2004 6	IMMUNOLOGY	7055	38
2004 7	TOXICOLOGY	322	322
2004 8	SEND OUT	3238	51
2004 9	ANMC BLOODBANK	1	
2004 10	MANUAL	2915	2915
2004 13	ESR	460	460
2004 15	BLOOD BANK	15	15
2004 16	CYTOLOGY	4	1
2004 17	POINT OF CARE	3377	3377
2005 1	HEMATOLOGY	10712	10712
2005 2	EKTACHEM	12298	12298
2005 4	MICROBIOLOGY	4866	
2005 5	URINALYSIS	4679	4679
2005 6	IMMUNOLOGY	6777	
2005 7	TOXICOLOGY	311	311
2005 8	SEND OUT	3526	
2005 10	MANUAL	3054	3054
2005 13	ESR	471	471
2005 15	BLOOD BANK	24	24
2005 16	CYTOLOGY	2	
2005 17	POINT OF CARE	4757	4757
2006 1	HEMATOLOGY	11765	11765
2006 2	EKTACHEM	12976	12976
2006 4	MICROBIOLOGY	4996	
2006 5	URINALYSIS	5219	5219
2006 6	IMMUNOLOGY	7801	
2006 7	TOXICOLOGY	285	285
2006 8	SEND OUT	3957	
2006 9	ANMC BLOODBANK	1	
2006 10	MANUAL	4040	4040
2006 11	URINE MICRO	1	1
2006 13	ESR	583	583
2006 15	BLOOD BANK	31	31
2006 16	CYTOLOGY	45	
2006 17	POINT OF CARE	5796	5796

2007 1	HEMATOLOGY	12891	9875
2007 2	EKTACHEM	14494	11083
2007 4	MICROBIOLOGY	5679	
2007 5	URINALYSIS	6027	4587
2007 6	IMMUNOLOGY	9521	
2007 7	TOXICOLOGY	271	187
2007 8	SEND OUT	4663	
2007 10	MANUAL	5249	3752
2007 13	ESR	836	636
2007 15	BLOOD BANK	28	23
2007 16	CYTOLOGY	103	
2007 17	POINT OF CARE	16096	11504
2008 1	HEMATOLOGY	2536	
2008 2	EKTACHEM	2897	
2008 4	MICROBIOLOGY	1185	
2008 5	URINALYSIS	1105	
2008 6	IMMUNOLOGY	1933	
2008 7	TOXICOLOGY	43	
2008 8	SEND OUT	975	
2008 10	MANUAL	1310	
2008 13	ESR	123	
2008 15	BLOOD BANK	9	
2008 16	CYTOLOGY	32	
2008 17	POINT OF CARE	4657	
TOTAL		450096	305628

Figure 3-8: Report Example

3.2.5 Orphan" Entries Totals Report

The selection of the "Orphan" Entries Report option will call a subroutine that will compile the data and then display a very brief report. It will look similar to the following:

```

                                DEMO HOSPITAL
Date:01/14/09                    IHS Lab Accession File                Time:9:29 AM
                                "C" Index "Orphan" Report            BLRCINDX
-----
Counting "Orphan" Pointers in Accession File's "C" Index
*****
*****.....*****
*****.....*****
*****.....*****
*.....*****
.....*****
*****.....*.....
Number of Pointers in "C" Index = 450096
Number of "Orphan" Pointers in "C" Index = 305628

REPORT ENDS.  Press RETURN Key:
    
```

Figure 3-9: "Orphan" Entries Report Example

4.0 Modified Routines

Several routines have been modified in order to prevent errors and/or correct issues.

This routine ...	was modified to ...
BLREXEC2	Prevent a <PARAMETER> error when using either the Delta Check for IDMS-Traceable MDRD Study Equation where Creatinine is in mg/dl (conventional Units) or the Delta Check for IDMS-Traceable MDRD Study Equation where Creatinine is in $\mu\text{mol/L}$. Also modified the routine to fix an issue with Creatinine results less than one.
BLRPOC	Fix a problem with the Nature of Order not being correctly set for an OE/RR order. Modified to prevent <UNDEFINED> error when SMP variable is zero.
BLRTN	Prevent <UNDEFINED> error when BLRACCN variable not defined. Modified lines due to their length. Code moved to other routines due to BLRTN routine size.
BLRTNB	Prevent <SUBSCRIPT> error when BLRLRDFN variable not set.
BLRTNM	Prevent <UNDEFINED> error when BLRTEST variable not defined.
LRAC1	Prevent <UNDEFINED> error when LRLLOC variable not defined.
LRPHSET	Prevent <UNDEFINED> error when IOF variable not defined.
LRRP1	Correct issue with Date of Birth and Age on tasked Interim Reports.
LRUPA2	Correct a problem with incorrect patient name printing on Accession list by number Report.

5.0 New Routines

Several routines will be added to the IHS Lab module.

New routine	Description
BLRCINDEX	Post install routine that can be run by site manager to purge invalid pointers from the Accession file's "C" Index, or produce reports on the Accession file's "C" Index.
BLRPRE26	IHS Lab PATCH 1026 Environment/Post Install Routine
BLRTNDEL	Routine created by the removal of the deletion code from the BLRTN routine.
BLRTNRES	Routine created by the removal of the results code from the BLRTN routine.

6.0 Glossary

Atomic Test

A single Lab test.

Cosmic Test

A Lab Test consisting of a panel of Atomic Tests.

Daemon

A program that runs continuously and exists for the purpose of handling periodic service requests that a computer system expects to receive. The daemon program forwards the requests to other programs (or processes) as appropriate.

File

A set of related records or entries treated as a single unit.

FileMan

The database management system for RPMS.

Global

In MUMPS, global refers to a variable stored on disk (global variable) or the array to which the global variable may belong (global array).

IEN

Internal Entry Number. A unique number used to identify an entry within a file.

IHS

Indian Health Service.

Infinite Recursion

An infinite recursive loop, especially one involving a recursive function whose stopping criteria are never met.

Journaling

The real-time logging of all database management system updates. This information is used to reconstruct databases in the event of a database failure.

Locking

A method of synchronizing potentially concurrent uses of a database or other common resource. Typically, a lock is of temporary duration and when the resource is no longer required, it is freed for locking and use by the next sharer in a queue.

Menu

A list of choices for computing activity. A menu is a type of option designed to identify a series of items (other options) for presentation to the user for selection. When displayed, menu-type options are preceded by the word “Select” and followed by the word “option” as in Select Menu Management option: (the menu’s select prompt).

MUMPS

Massachusetts General Hospital Utility Multiprogramming System. It is a procedural, interpreted general-purpose programming language oriented towards database applications.

Naked Syntax

In MUMPS, a shorthand form of specifying the most recently referenced global node.

Parameter

A name in a function or subroutine definition that is replaced by, or bound to, the corresponding actual argument when the function or subroutine is called.

<PARAMETER>

A Cache error caused by the number of parameters passed to a labeled routine by a user-written function reference or a DO command exceeding the number of formal parameters declared for the labeled line.

POC

Point-Of-Care. A Laboratory test that is performed at the site of care (examination, treatment, diagnosis, etc.).

Recursion

A programming technique in which a program or routine calls itself to perform successive steps in an operation, with each step using the output of the preceding step.

RPMS

Resource and Patient Management System. A suite of software applications used at IHS facilities to support administrative, clerical, and clinical functions.

<SYNTAX>

A Cache error caused by the malformation of a language construct, such as a misspelled or missing keyword.

UID

Universal ID. A number generated by the Lab system that uniquely identifies an Accession, no matter the year.

<UNDEFINED>

A Cache error caused by a reference to an undefined variable.

7.0 Appendix A: Test Scripts

Software changes should be tested *in the manner that you use the feature/function in your environment*. If for example lab results are viewed and printed in the EHR, the EHR should be included in your testing. The test scripts below are meant to provide a place for you to begin creating your own test script.

7.1 Prevent Infinite Recursion

This software change prevents the definition of a test panel that will cause infinite recursion (an unending loop).

Test Steps

1. Modify a Lab Panel
 - a. Enter the Lab Panel test as one of its own tests (i.e. Add the BMP panel as a test to a BNP panel)
 - b. If it refuses, then PASS (the system should not give you the ability to add a panel as an individual test to another panel).
2. Create a New Lab Panel
 - a. Enter several Lab tests
 - b. Enter the New Lab Panel as one of its tests
 - c. If it refuses, then PASS (the system should not give you the ability to add a panel as an individual test to another panel).

7.2 Accession File's "C" Index Issue

This software change provides a routine to delete “orphan” Accession file (#68) pointers and provides reports for the Accession files “C” Index.

Test Steps

1. Run the BLRCINDEX routine
2. If the routine does not find any anomalies, then PASS
3. If it does find something, then:
 - a. Run the reports
 - b. If the reports run and all work, then PASS
 - c. Delete the "orphan" entries

- d. Re-run the BLRCINDEX routine
- e. If there are no "orphan" entries to report, then PASS

7.3 Estimated GFR Generates an Error (Routine BLREXEC2)

This software change addresses a defect in the new functionality for the National Kidney Disease Foundation's Latest Estimated GFR. Please see the *Laboratorian Guide for Patch 25* for details on the definition and use of this functionality.

Test Steps

1. If one of the new IDMS-Traceable MDRD Study Equations can be used without error, then PASS.

7.4 Change Request for EHR Point of Care Testing (Routine BLRPOC)

This testing only applies to sites who have installed EHR Version 1.1 patch 5 or greater. Please see the EHR documentation, *RPMS-EHR New Features (EHR) Setup Guide*, Version 1.1, Patch 5, July 2009 for further details on how to setup and use the EHR POC lab entry button.

1. If POC tests can be ordered and resulted in EHR, and then viewed in EHR and Lab, then PASS.

7.5 BLRTN fixed (BLRTND and BLRTNR created)

Test Steps

1. If a Lab test is cancelled and no <UNDEFINED> error, then PASS
 - a. If a Lab to PCC linker continues to work, then PASS.

7.6 Blood Bank Test Generates an Error (Routine BLRTNB)

Test Steps

1. If a Blood Bank Lab test is cancelled and no <SUBSCRIPT> error, then PASS.

7.7 BLRTNM fix

Test Steps

1. If a gram stain is incorrectly named and then cancelled and there is no <UNDEFINED> error, then PASS.

7.8 LRAC1

Test Steps

1. If lab test cancelled and no <UNDEFINED> error, then PASS.

7.9 LRPHSET

This fixes a defect causing an <UNDEFINED> error from occurring when IO variables are not defined.

Test Steps

1. Task the LRPHSET option. If it continues to run, then PASS.

7.10 Interim Report DOB Missing or Incorrect (Routine LRRP1)

Patch 25 introduced a defect that causes the patient's date-of-birth (DOB) on Interim Reports when called through TaskMan to be missing or incorrect. This issue does not occur when the Interim Report is immediately generated after the user approves the result(s). However, some sites use TaskMan routines to generate Interim Reports the following day, and this is when the patient's DOB is incorrectly reported. The issue does not occur in the EHR.

Test Steps

1. Select 3 demo test patients. Note the patients' DOB.
2. Order and result a lab test for each demo patient
3. Use TaskMan to generate an Interim Report for each patient for the following day. (Note: You may need your site manager's assistance to perform this step).
4. If the patients' DOB in the IR header is as noted in step a, then PASS.

7.11 Accession List by Number Report issue (Routine LRUPA2)

This software change corrects an issue with incorrect patient names qualifying to print on the Accession List by Number Report.

Test Steps

1. Call an Accession List by Number report.
2. If the Accession List by Number report lists names correctly, then PASS.

8.0 Appendix B: Checklist

Section	Test Date	Description	PASS	FAIL
3.1		Prevent Infinite Recursion		
3.2		Accession File's "C" Index Issue		
3.3		Estimated GFR generates an error (BLREXEC2)		
3.4		EHR Point of Care Feature (BLRPOC)		
3.5		BLRTN fixed & BLRTND, BLRTNR created		
3.6		Blood Bank test generates an error (BLRTNB)		
3.7		BLRTNM		
3.8		LRAC1		
3.9		LRPHSET		
3.10		Interim Report DOB missing/incorrect (LRRP1)		
3.11		Access List by Number Report issue (LRUPA2)		

9.0 Contact Information

This document is for the ALPHA test release of IHS Lab Patch 1026.

If you have any questions or comments regarding this document, contact one of the IHS Lab team:

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Michael Kring	Developer	(505) 248-4125	michael.kring@ihs.gov

Contact the OIT Help Desk (IHS).

Phone: (505) 248-4371 or (888) 830-7280 (toll free)

Fax: (505) 248-4363

Web: <http://www.ihs.gov/GeneralWeb/HelpCenter/Helpdesk/index.cfm>

Email: support@ihs.gov