

Why You Can't Get Accurate Real Time Data from Your LIS - and How to Fix That Problem!

Richard Ouellette, MS, FACHE, MT(ASCP)H

Management Decision Systems, Inc.



***Atlanta, Georgia
September 24, 2008***

Overview

- ☞ Can I get the data out of my LIS?
- ☞ Rethinking The Laboratory
- ☞ The IS Enterprise & Data Collection
- ☞ Data Conversion (ETL)
- ☞ Real-Time Data
- ☞ Data Models & Schema
- ☞ Data - Quality
- ☞ Automation

Re-Thinking The Laboratory

- ☞ Is your laboratory a provider of tests or *INFORMATION*?
- ☞ The laboratory is the single largest producer of clinical information in healthcare.
- ☞ The Laboratory generates 70 – 80% of the contents of a medical record.
- ☞ As a clinical diagnostic tool the laboratory can help identify 95% of the diseases known to mankind

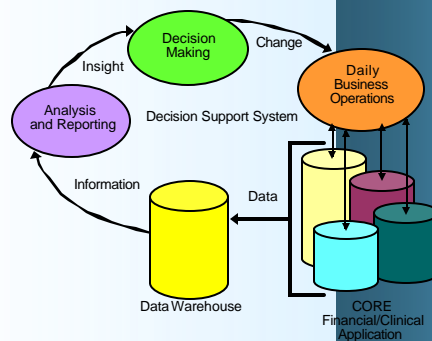
**The Laboratory
is a detail-oriented
business.**

Can I get data off my LIS?

Yes

Blending LIS Data & Warehousing

Business Intelligence Cycle

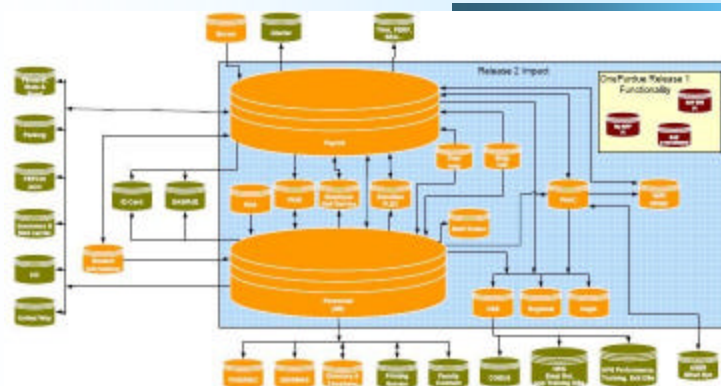


The cycle begins with the day-to-day operations that generate data, which is passed to the warehouse. This information is analyzed and reported to provide timely decision making then used proactively to continuously improve daily operations and patient care.

Data Collection

- **Management data often difficult to extract**
- **Sources of data – LIS, Finance, etc.**
- **Data Types**
 - **Preformatted & good to go**
 - **Raw & unformatted**
 - **Existing softcopy reports**

Enterprise Interface Flow Diagram



ETL

Data Extraction Data Conversion Transformation Load

Data - Structured/Unstructured

Structured

Date - 01/03/2008, 1/3/08, 03JAN08

Character - Jakes MD, 5th Floor, STAT

Number - 5.4, 2309, 10

Unstructured

Called Dr. Ross office at 4:45 AM with critical glucose result of 375. Spoke with Susie Q. She read back the results & will communicate.

Unstructured Data

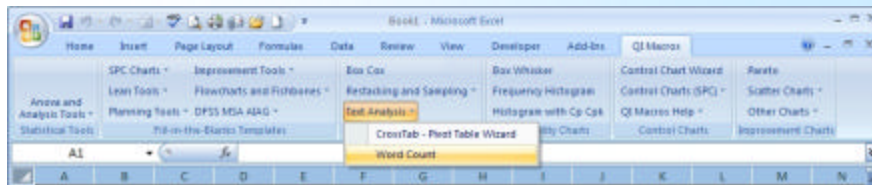
Examples

Surveys – Open ended questions
LIS Comment – Critical value calls

Options

- Word counts & word patterns
- LIS Macros & string manipulation

Unstructured Data Word Counts



P	
1	MEMOTEXT - Wordcount
2	DA REJECT - DUP DOS (MULTIPLE VISITS SAME DAY) - OLD AND TT SHELLEY AT AETNA WAS TOLD - THAT THIS SHOULD BE INCLUDED IN THE SURGERY CHARGES. E-MAILED GARY S TO SEE IF THIS IS - CORRECT. THE SURGERY ACCT IS IN MC STATUS. CATHY X266 DANIEL RAKE FROM DAVIS WIRE 0 CALLED TODAY THEY RECVD A W/C CLAIM FOR THIS PT AND THEY ARE NOT ASSOCIATED WITH DAVIS WIRE IN THAT - REGARD... THE INS INFO IS INCORRECT. WILL DELETE AND REFER TO W/C FOLLOWUP. ADAVIS
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

A	
1	Count of Word
2	Word
3	reject
4	dos
5	overlapping
6	dc
7	claim
8	mc
9	denied
10	max
11	days
12	stay
13	acct
14	cochmidt

B	
1	Total
2	489
3	433
4	370
5	362
6	202
7	146
8	143
9	122
10	105
11	103
12	94
13	93



KnowWare International
<http://www.qimacros.com/>

Sources of Data - LIS

DSI Master Data File for LIS

Accession	Code	Testcode	Priority	Location	Md id	Deptno	Date
F1032898	TBP3	DI	R	2ELP	14768	TS	02/21/08
F1035206	URNC	CULT	R	CS7200	99142	MC	02/22/08
F1036676	YCOCSE	YCABCF	R	PACULP	17199	YR	02/22/08
F1039610	TBP	PID	R	SAUPRE	047139	TS	02/22/08
F1039610	TBP1	PID	R	SAUPRE	047139	TS	02/22/08
F1039661	TBP3	PID	R	3WLP	14499	TS	02/22/08
F1041892	SLHED	SLHED	R	EGR	14981	AH	02/28/08
F1042078	SLHED	SLHED	R	E1	12767	AH	02/28/08
F1042271	SLHED	SLHED	R	E2	8888	AH	02/28/08
F1042522	ZZ00	AMP	R	2ELP	037611	MC	02/28/08
F1042687	URNC	RPT	R	B1	036486	MC	02/28/08
F1043233	YHABQ	YHAB1	S	E2	12179	YF	02/28/08
F1043371	SLHED	SLHED	R	2ELP	15417	AH	02/29/08
F1043441	URNC	CULT	R	ED	10297	MC	02/29/08
F1043491	URNC	CULT	R	ED	15278	MC	02/29/08
F1043491	USID	USID	R	ED	15278	MC	02/29/08
F1043491	ZZ00	CC	R	ED	15278	MC	02/29/08
F1043587	RESPG	RPT	R	CS2904	82122	MC	02/29/08
F1043860	TCDIF	CULT	R	EGR	046070	MC	02/29/08

Typical Data Approaches

- ✍ Ask IT for data elements & format
 - ...and they give it to you
- ✍ Use existing report formats & extract
 - Monarch - Pattern Analysis
 - Excel/Access & Other
- ✍ Coding – Last resort
 - Recursion - Line/Byte

Extraction Transformation Load (ETL) In-House IT - Finding A Pattern

06/21/08 Thru 06/21/08			
RECORDING thru END			
00000216 DAMS,KEVIN 23/W <RES SEP 06/21> CONSULT Binkes,Martin S.			
0621:00000000 COMP, Coll: 06/21/08-1945 Recd: 06/21/08-1714 (0602179553) Binkes,Martin S			
Ordered: GUD			
Comment: 410-276-4493			
Entered: 06/21/08-1714 Rg: WTS.MGR Collected by: CE Received by: WTS.MGR			
Ord For: 06/21/08-1945			
Queries: ICD-9:			
Medical Necessity:			
GUD0000 69 69-118 MG/EL Em: 06/21-1743 autoins, Ver: 06/21-1749 LAB.MOC			
Method: OLIMPUS AD640- INSTRUMENT Analyzer: OLY1			
0621:00000000 COMP, Coll: 06/21/08-1945 Recd: 06/21/08-1714 (0602179553) Binkes,Martin S			
Ordered: CMOG			
Comment: 410-276-4493			
Entered: 06/21/08-1714 Rg: WTS.MGR Collected by: CE Received by: WTS.MGR			
Ord For: 06/21/08-1945			
Queries: ICD-9:			
Medical Necessity:			
GUD00000000 138 138-200 MG/EL Em: 06/21-1739 autoins, Ver: 06/21-1749 LAB.MOC			
Method: OLIMPUS AD640- INSTRUMENT Analyzer: OLY1			
0000000000 DAMS,KEVIN 27/F <RES CK 06/19> (060461112) 840-1-08 Desantha-Romer,MarcusLAKHAN			
0621:00000000 COMP, Coll: 06/21/08-0850 Recd: 06/21/08-0833 (0602179165) Desantha-Romer,			
Ordered: CMO, LCH			
Entered: 06/21/08-0850 Rg: WTS.ATP Collected by: WTS.TCH Received by: LAB.GDR			
Ord For: 06/21/08-0850			
GUD			
GUD00000 99 99-118 MG/EL Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
WTS 10 9-28 MG/EL Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
CREATININE 3.1 0.6-2.8 MG/DL Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
BUN 138 187-146 MMOL/L Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
POTASSIUM 4.2 0.6-6.2 MMOL/L Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
CHLORIDE 101 100-108 MMOL/L Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			

Copyright © 1999-2008 Management Decision Systems, Inc.

MAST®

15

Extraction Transformation Load (ETL) In-House IT - Finding A Pattern

Ordered Date & Time

06/21/08 Thru 06/21/08			
RECORDING thru END			
00000216 DAMS,KEVIN 23/W <RES SEP 06/21> CONSULT Binkes,Martin S.			
0621:00000000 COMP, Coll: 06/21/08-1945 Recd: 06/21/08-1714 (0602179553) Binkes,Martin S			
Ordered: GUD			
Comment: 410-276-4493			
Entered: 06/21/08-1714 Rg: WTS.MGR Collected by: CE Received by: WTS.MGR			
Ord For: 06/21/08-1945			
Queries: ICD-9:			
Medical Necessity:			
GUD0000 69 69-118 MG/EL Em: 06/21-1743 autoins, Ver: 06/21-1749 LAB.MOC			
Method: OLIMPUS AD640- INSTRUMENT Analyzer: OLY1			
0621:00000000 COMP, Coll: 06/21/08-1945 Recd: 06/21/08-1714 (0602179553) Binkes,Martin S			
Ordered: CMOG			
Comment: 410-276-4493			
Entered: 06/21/08-1714 Rg: WTS.MGR Collected by: CE Received by: WTS.MGR			
Ord For: 06/21/08-1945			
Queries: ICD-9:			
Medical Necessity:			
GUD00000000 138 138-200 MG/EL Em: 06/21-1739 autoins, Ver: 06/21-1749 LAB.MOC			
Method: OLIMPUS AD640- INSTRUMENT Analyzer: OLY1			
WTS 10 9-28 MG/EL Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
CREATININE 3.1 0.6-2.8 MG/DL Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
BUN 138 187-146 MMOL/L Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
POTASSIUM 4.2 0.6-6.2 MMOL/L Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			
CHLORIDE 101 100-108 MMOL/L Em: 06/21-1734 autoins, Ver: 06/21-1739 LAB.VOM			
Method: OLIMPUS AD640 Analyzer: OLY1			

Copyright © 1999-2008 Management Decision Systems, Inc.

MAST®

16

Verified & Entered Date/Time and Result

NAACID/ID	1-8	1-9-2-V	MS/CL	Ext.	NAAC/TYPE	NAAC/ISS	Var.	NAAC/ISS	NAAC/ISS
06/21/08 Thru 06/21/08									
REGISTRATION thru RDD									

CO08216	DRAG, KEVIN	2A/N	CHRD	REF	06/21/08	CONNELLY	Blissard, Martin E.		
0621-CO08216	COMP.	Coll:	06/21/08-1846	Read:	06/21/08-1714	RP02179663	Blissard, Martin E		
Ordered: SLD									
Comment: 410-276-6091									
Entered: 06/21/08-1714 By: KSR.NQH									
Collected by: CK									
Received by: WJR.NQH									
Ord for: 06/21/08-1846									
Quantity: ICD-9									
Medical History:									
NAAC/ISS	ISS	IS-110 MS/CL		Ext.	06/21-2766	NAAC/ISS	Var.	06/21-2766	NAAC/ISS
Method: CLVDGPOU A0440- INSTRUMENT									
Analyses: CLVZ									

0621-CO08216	COMP.	Coll:	06/21/08-1846	Read:	06/21/08-1714	RP02179663	Blissard, Martin E		
Ordered: SLD									
Comment: 410-276-6091									
Entered: 06/21/08-1714 By: KSR.NQH									
Collected by: CK									
Received by: WJR.NQH									
Ord for: 06/21/08-1846									
Quantity: ICD-9									
Medical History:									
NAAC/ISS	ISS	IS-100 MS/CL		Ext.	06/21-2766	NAAC/ISS	Var.	06/21-2766	NAAC/ISS
Method: CLVDGPOU A0440- INSTRUMENT									
Analyses: CLVZ									

[illegible]

Extraction Transformation Load (ETL) In-House IT - Finding A Pattern

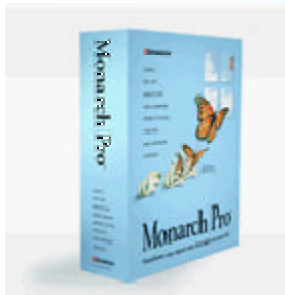
CODE	ML ID	AUT	Location	Accession	Access Num	Requisition	Priority
GLUCOSE	Linker, Martin R	REF	COMBETH	0621 C00212	C0089216	R#02179553	R
CHOLESTEROL	Linker, Martin R	REF	COMBETH	0621 C00213	C0089216	R#02179553	R
CMP	Vasantha-Kumar	IN	SN	0621 C00059	F1263102	R#02179165	R
CBC	Vasantha-Kumar	IN	SN	0621 H00056	F1263102	R#02179165	R
PROTIME & PT	Vasantha-Kumar	IN	SN	0621 H00056	F1263102	R#02179165	R
GGT	Anandakrishnan	IN	SN	0621 C00119	F1263102	R#02179326	R
CBC	Devis, Stephanie	IN	2S	0621 H00046	F1263368	R#02179148	R
SERUM PREG TEST	Alejandro, Rolando	SDC	REFOS	0621 C00114	F1260876	R#02179365	S
CK	Jason, Casey Joh	ER	ER	0621 C00254	F1263784	R#02179618	S
CKMB	Jason, Casey Joh	ER	ER	0621 C00254	F1263784	R#02179618	S
TROPONIN-T	Jason, Casey Joh	ER	ER	0621 C00254	F1263784	R#02179618	S
CADI	Jason, Casey Joh	ER	ER	0621 H00181	F1263784	R#02179618	S
BNP(EL7)	Jason, Casey Joh	ER	ER	0621 C00255	F1263784	R#02179611	U
BTOR	Jason, Casey Joh	ER	ER	0621 C00056	F1263784	R#02179612	U
GLUCOSE	Linker, Martin R	REF	COMBETH	0621 C00216	C0089209	R#02179534	R
DILANTIN	Dewberry, Robert	IN	4N	0621 C00007	F1260749	R#02179154	R
BNP(EL7)	Geh, Kenneth E A	IN	4N	0621 C00043	F1260749	R#02179169	R
PROSPORUS	Geh, Kenneth E A	IN	4N	0621 C00043	F1260749	R#02179169	R
MAGNESIUM	Geh, Kenneth E A	IN	4N	0621 C00043	F1260749	R#02179169	R
CPC	Geh, Kenneth E A	IN	4N	0621 H00059	F1260749	R#02179169	R
TDM	Geh, Kenneth E A	IN	4N	0621 C00004	F1260749	R#02179178	R
RPH	Geh, Kenneth E A	IN	4N	0621 C00004	F1260749	R#02179178	R
CBC	Mavrophilipos, D	IN	4S	0621 H00016	F1261604	R#02179099	R
CBC	Gibbs, Sherilyn D	IN	2S	0621 H00194	F1262847	R#02179664	S
UREO	Gibbs, Sherilyn D	IN	2S	0621 C00047	F1262847	R#02179666	R
BNP(EL7)	Jason, Casey Joh	ER	ER	0621 C00135	F1263652	R#02179412	U
ARYLASE	Jason, Casey Joh	ER	ER	0621 C00135	F1263652	R#02179412	U
STPASE	Jason, Casey Joh	ER	ER	0621 C00135	F1263652	R#02179412	U
UREO	Jason, Casey Joh	ER	ER	0621 C00015	F1263652	R#02179412	U
CADI	Jason, Casey Joh	ER	ER	0621 H00126	F1263652	R#02179412	U
BNP(EL7)	Owusu, Kofi	IN	SN	0621 C00080	F1263323	R#02179218	R
PROSPORUS	Owusu, Kofi	IN	SN	0621 C00080	F1263323	R#02179218	R
MAGNESIUM	Owusu, Kofi	IN	SN	0621 C00080	F1263323	R#02179218	R
CPSE	Owusu, Kofi	IN	SN	0621 H00079	F1263323	R#02179218	R
PROTIME & PT	Owusu, Kofi	IN	SN	0621 H00082	F1263323	R#02179218	R
D-DIMER QUANT	Owusu, Kofi	IN	SN	0621 H00082	F1263323	R#02179218	R

Copyright © 1999-2008 Management Decision Systems, Inc.

MAST®

19

Extraction Transformation Load (ETL) In-House IT - Finding A Pattern



Monarch
Datawatch Corporation
<http://www.datawatch.com>

Copyright © 1999-2008 Management Decision Systems, Inc.

MAST®

20

420,000 Reportable test kits/day

Copyright © 1999-2008 Management Decision Systems, Inc.

21

```
if strlen("4Time_c10:4Time_c20")==5 then Time_p = strfix("4Time_c10:4Time_c20"," ",6)
if strlen("4Time_c10:4Time_c20")<5 then Time_p = strfix("", " ",6)

sOrder_ID = strtrim(TreatExtract(43, line, "-")) : 45
if sOrder_ID == "Success" then Order_ID = "Success" (43 & 45)
if sOrder_ID == "Failure" then Order_ID = "Failure" (43 & 45)
```

Copyright© 1999-2008 Management Decision Systems, Inc.

22

Extraction Transformation Load (ETL) Coding - Recursion Line/Byte

CODE	ML ID	AUT	Location	Accession	Access Num	Requisition	Priority
GLUCOSE	Linker, Martin R	REF	COMBLTH	0621 C00212	C0089216	R#02179553	R
CHOLESTEROL	Linker, Martin R	REF	COMBLTH	0621 C00213	C0089216	R#02179553	R
CMP	Demantha-Kumar	IN	SN	0621 C00059	F1263102	R#02179165	R
CBC	Vasantha-Kumar	IN	SN	0621 H00056	F1263102	R#02179165	R
PROTIME & PT	Vasantha-Kumar	IN	SN	0621 H00056	F1263102	R#02179165	R
GGT	Anandkrishnan	IN	SN	0621 C00119	F1263102	R#02179326	R
CBC	Devis, Stephanie	IN	2S	0621 H00046	F1263368	R#02179148	R
SERUM FPG TEST	Alejandro, Rolando	SDC	REFOS	0621 C00114	F1263076	R#02179355	S
CK	Jason, Casey Joh	ER	ER	0621 C00254	F1263784	R#02179618	S
CKMB	Jason, Casey Joh	ER	ER	0621 C00254	F1263784	R#02179618	S
TROPONIN-T	Jason, Casey Joh	ER	ER	0621 C00254	F1263784	R#02179618	S
CADI	Jason, Casey Joh	ER	ER	0621 H00181	F1263784	R#02179618	S
BNP(EL7)	Jason, Casey Joh	ER	ER	0621 C00255	F1263784	R#02179611	U
BTOK	Jason, Casey Joh	ER	ER	0621 C00056	F1263784	R#02179612	U
GLUCOSE	Linker, Martin R	REF	COMBLTH	0621 C00216	C0089209	R#02179534	R
DILANTIN	Dewberry, Robert	IN	4N	0621 C00007	F1260749	R#02179154	R
BNP(EL7)	Geh, Kenneth E A	IN	4N	0621 C00043	F1260749	R#02179169	R
PROSPORUS	Geh, Kenneth E A	IN	4N	0621 C00043	F1260749	R#02179169	R
MAGNESIUM	Geh, Kenneth E A	IN	4N	0621 C00043	F1260749	R#02179169	R
CPC	Geh, Kenneth E A	IN	4N	0621 H00059	F1260749	R#02179169	R
TDM	Geh, Kenneth E A	IN	4N	0621 C00004	F1260749	R#02179178	R
RPH	Geh, Kenneth E A	IN	4N	0621 C00004	F1260749	R#02179178	R
CBC	Mavrophilipos, D	IN	4S	0621 H00016	F1261604	R#02179099	R
CRC	Gibbs, Sherilyn D	IN	2S	0621 H00194	F1263847	R#02179664	S
UREU	Gibbs, Sherilyn D	IN	2S	0621 C00047	F1263847	R#02179666	R
BNP(EL7)	Jason, Casey Joh	ER	ER	0621 C00135	F1263652	R#02179412	U
ARYLASE	Jason, Casey Joh	ER	ER	0621 C00135	F1263652	R#02179412	U
STPASE	Jason, Casey Joh	ER	ER	0621 C00135	F1263652	R#02179412	U
UREU	Jason, Casey Joh	ER	ER	0621 C00015	F1263652	R#02179412	U
CADI	Jason, Casey Joh	ER	ER	0621 H00126	F1263652	R#02179412	U
BNP(EL7)	Owusu, Kofi	IN	SN	0621 C00080	F1263323	R#02179218	R
PROSPORUS	Owusu, Kofi	IN	SN	0621 C00080	F1263323	R#02179218	R
MAGNESIUM	Owusu, Kofi	IN	SN	0621 C00080	F1263323	R#02179218	R
CPSE	Owusu, Kofi	IN	SN	0621 H00079	F1263323	R#02179218	R
PROTIME & PT	Owusu, Kofi	IN	SN	0621 H00082	F1263323	R#02179218	R
D-DIMER QUANT	Owusu, Kofi	IN	SN	0621 H00082	F1263323	R#02179218	R

Copyright© 1999-2008 Management Decision Systems, Inc.

MAST®

23

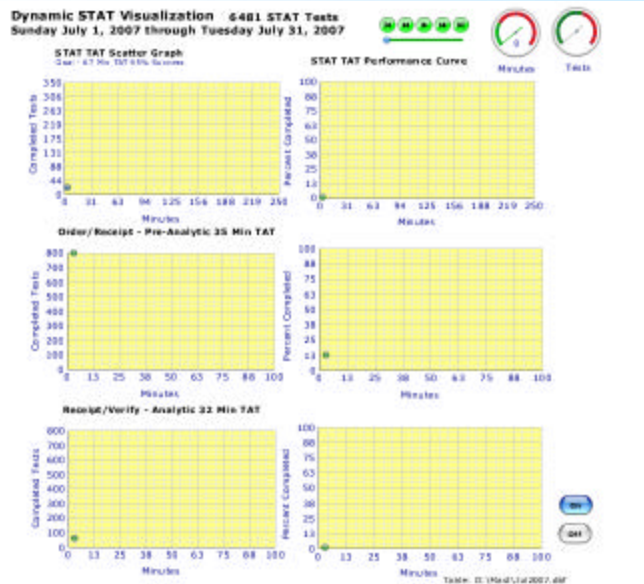
What Is Real-Time Data?

Copyright© 1999-2008 Management Decision Systems, Inc.

MAST®

24

Real-Time-Data Visualization



Copyright © 1999-2008 Management Decision Systems, Inc.

25

Realistically...

If you could get information on a real-time how often would you look at it?

What would you do with it?

Copyright © 1999-2008 Management Decision Systems, Inc.

MAST®

26

Hmmm OK...

Isn't email considered real-time information?

What do you do with it?

Our Healthcare Industry...

- Economics – A social good
- Mostly not-for-profit
- Most Hospitals did not have/use budgets until Medicare was introduced in 1965
- Cost based reimbursement was not widely replaced until the early 1980's
- We manage on a monthly basis, not daily
- Responsibility & accountability – Tough concepts

Data Models & Schema

Data Models & Schema

- Relational Database Schema
- Design is Key
- Considerations
 - Avoid redundancy - clinical vs. management
 - Billed vs. reportable – volume impact
 - Data refresh rate
 - Level of IT support – vendor/in-house

Test Counts

- ☞ Very important to know
- ☞ Billed Vs. Reportable/Broken
- ☞ Billed to reportable ratio is roughly 5
 - $3,000 \text{ Reqs} = 3,000 \times 2.5 = 7,500 \text{ Billables Vs. } 37,500 \text{ Reportables}$ BIG DIFFERENCE
- ☞ You get paid by billable tests
- ☞ Your CFO talks billable tests
- ☞ It's in your best interest to use billables as the denominator

**Better to be roughly right,
than precisely wrong**

Data Sequencing

- **You need rules...
to determine what data is
pulled into the data
warehouse on a daily basis.**

Data Sequencing

Definition

**”Rules you apply to the daily
extraction of data off the LIS to
ensure that there is no
duplication of data when
combined with previous days.”**

Data Sequencing - Example

"Only include data that was verified and released today 4/8/07 with a time stamp of 23:59:59 or earlier."

ACCESSION	LOCATION	CODE	DATE_ORG	DATE_DRM	DATE_SEC	DATE_VER
07-095-0338	ZCS	4309803	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0338	ZCS	4308806	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1463	CCU	4031330	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1463	CCU	4031793	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1463	CCU	4031795	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1463	CCU	4038864	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1453	BRC	4044400	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1288	7LTC	4044400	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1480	7E	4044400	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1466	CCU	4031794	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1488	CCU	4031798	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1463	CCU	4031794	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1451	HMB3	4044400	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-099-0006	BPA	4033081	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0006	BPA	4044400	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0002	CTI	4393014	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-098-0030	CCU	4393015	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0004	BRT	4043000	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0005	CTI	4044030	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0004	BRT	4044030	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0006	BRT	4044400	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1474	6E	4043000	4/7/2007	4/7/2007	4/8/2007	4/8/2007
07-095-0004	BRT	4033020	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0004	BRT	4033077	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0005	CTI	4033088	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1473	CCU	4043000	4/7/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0013	BPA	4043000	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0003	CTI	4043305	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1473	CCU	4044030	4/7/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0013	BPA	4044030	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0013	BPA	4033020	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0011	BPA	4033077	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1473	CCU	4033020	4/7/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1473	CCU	4033077	4/8/2007	4/8/2007	4/8/2007	4/8/2007

35

Copyright © 1999-2008 Management Decision Systems, Inc.

Data Sequencing - Example

"Sorting by Date Drawn... a portion of tests have earlier draw dates than Date-of-Verification."

ACCESSION	LOCATION	CODE	DATE_ORG	DATE_DRM	DATE_SEC	DATE_VER
07-097-1463	CCU	4031330	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1463	CCU	4031793	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1463	CCU	4031795	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1463	CCU	4038864	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1453	BRC	4044400	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1288	7LTC	4044400	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1480	7E	4044400	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1466	CCU	4031794	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1488	CCU	4031798	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1463	CCU	4031794	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1451	HMB3	4044400	4/7/2007	4/7/2007	4/7/2007	4/8/2007
07-097-1474	6E	4043000	4/7/2007	4/7/2007	4/8/2007	4/8/2007
07-095-0338	ZCS	4309803	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0338	ZCS	4308806	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0006	BPA	4032091	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0006	BPA	4044400	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0002	CTI	4393015	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0030	CCU	4393014	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0004	BRT	4043000	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0003	CTI	4044030	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0004	BRT	4044030	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0006	BRT	4044400	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0004	BRT	4033020	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0004	BRT	4033077	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0005	CTI	4033088	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1473	CCU	4043000	4/7/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0013	BPA	4043000	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0003	CTI	4043305	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1473	CCU	4044030	4/7/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0013	BPA	4044030	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-095-0013	BPA	4033020	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-099-0011	BPA	4033077	4/8/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1473	CCU	4033020	4/7/2007	4/8/2007	4/8/2007	4/8/2007
07-097-1473	CCU	4033077	4/8/2007	4/8/2007	4/8/2007	4/8/2007

36

Copyright © 1999-2008 Management Decision Systems, Inc.

Data Sequencing

Keep in mind the following:

...as a general rule 85% of all of your tests are ordered and reported on the same day.

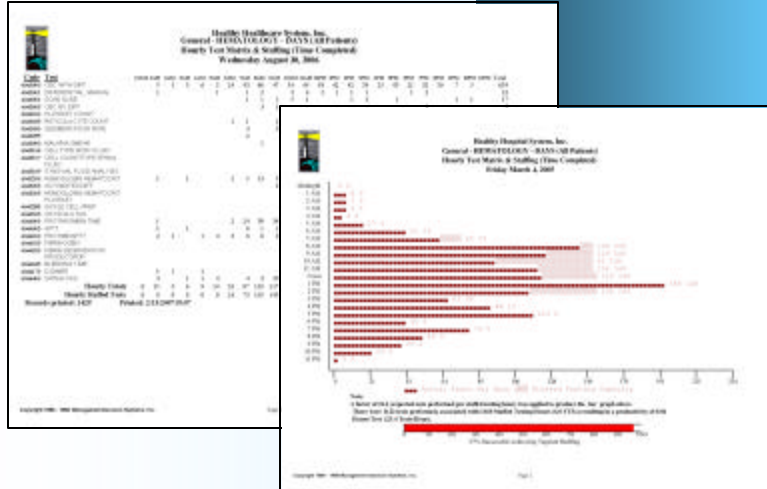
... only 25% of microbiology tests will be reported on the same day; maybe less.

Data Sequencing

Using Date Verified Criteria for a given single day you can...

- **Examine analytic processes**
- **Assess Analytic staffing to tests**
- **Perform Service Turn-Around-Time, e.g., STAT TAT from order to verify**

Analytical Productivity



Overall Turn-Around-Time



Data Sequencing

Using Date Verified Criteria for a given single day you can NOT ...

- Examine pre-analytic processes
- Assess pre-analytic staffing to accessions

Data Sequencing – Pre-Analytic

Phlebotomy production graph below was derived from daily (verified) data extractions from August 4th - 11th .



Data Sequencing

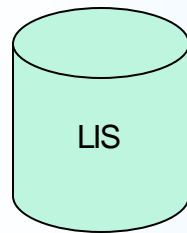
**Aren't most of the problems
associated with the testing
continuum related to pre-analytic
processes?**

You can bet they are!

Data Quality

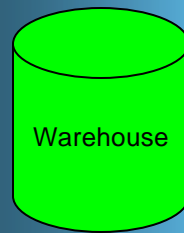
What is truth?

Your existing LIS data.



Primary Data
Source

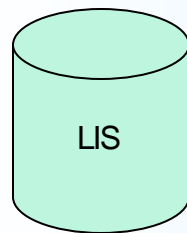
=



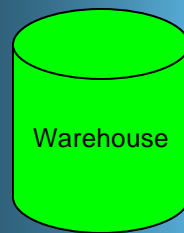
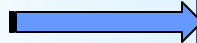
Data
Repository

Data Quality - Options

- Manual Verification
- SQL Script – Existing Known's
- Ongoing Data Profiling - Inquiry

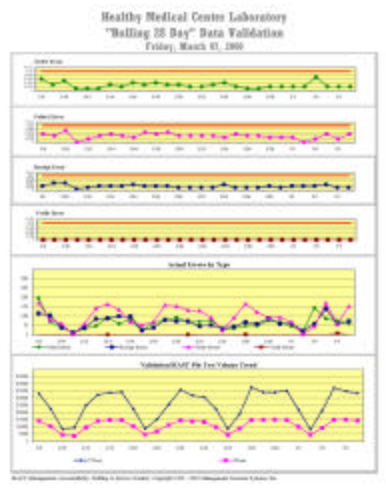


Primary Data
Source



Data
Repository

Data Quality - Dashboard



Copyright © 1999-2008 Management Decision Systems, Inc.

Daily control charts

- LIS Mgt. reports truth Vs. daily data extraction
- Timestamps monitored
- Error threshold 1/1,000

MAST®

47

Automation

Copyright © 1999-2008 Management Decision Systems, Inc.

MAST®

48

Summary Remarks

- ☞ Useful data can be extracted from any LIS
- ☞ To be useful data often needs to be integrated with multiple enterprise sources
- ☞ A well defined data model/schema takes into account granularity
- ☞ Data sequencing and refresh rates must be balanced between LIS impact and usefulness
- ☞ Data quality must be monitored daily; the repository must match the source
- ☞ Automation makes it all transparent

Thank you!

Where to Get More Information

- ☞ The MDS website <http://www.mandecsys.com>
- ☞ Contact information:
 - Richard Ouellette, MS, FACHE, MT(ASCP)H
 - ✉ e-mail: rouellette@mandecsys.com
 - ✉ Phone: **508.829.7813**