SIMPLE LABORATORY DATA

Examples of Standardization in the Veterans Affairs

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My Background

2007	University of Michigan – Bachlors in Engineering (B.S.E.)
2011	Yale University School of Medicine – Medical Doctorate (M.D.)
2013	Recipient Epidemiology and Donor Evaluation Study-III (REDS-III) – Informatics Core
2014	Yale-New Haven Hospital – Resident in Laboratory Medicine
	American Board of Pathology, Certification in Clinical Pathology
	Yale University School of Medicine – Instructor
2015	Veterans Affairs Connecticut Healthcare System – Clinical Chemistry
2016	American Board of Pathology, Certification in Clinical Informatics
2017	Project Management Professional (PMP) Cerification

Projects

Topic	Description
Results	“Set of codes” – An issue with CDW data extraction
	“Retrospective” - Standardization of CDW laboratory results
	“Prospective” – Interacting with Sta3ns to standardize laboratory reports
Tests	“Identifiers” – LOINC code assignments
	“Quality Control” – statistical evaluations of laboratory tests and results
LOINC	“Hierarchy” – LOINC code looks for assignment and retrieval
	“Units” – Interconversion of LOINC codes with different units
Outbox	“Outbox” – Access to standardized tests and results on the CDW

SET OF CODES

An issue with CDW data extraction

Set of Codes

Agenda:

HIV Cube – 2.7.17

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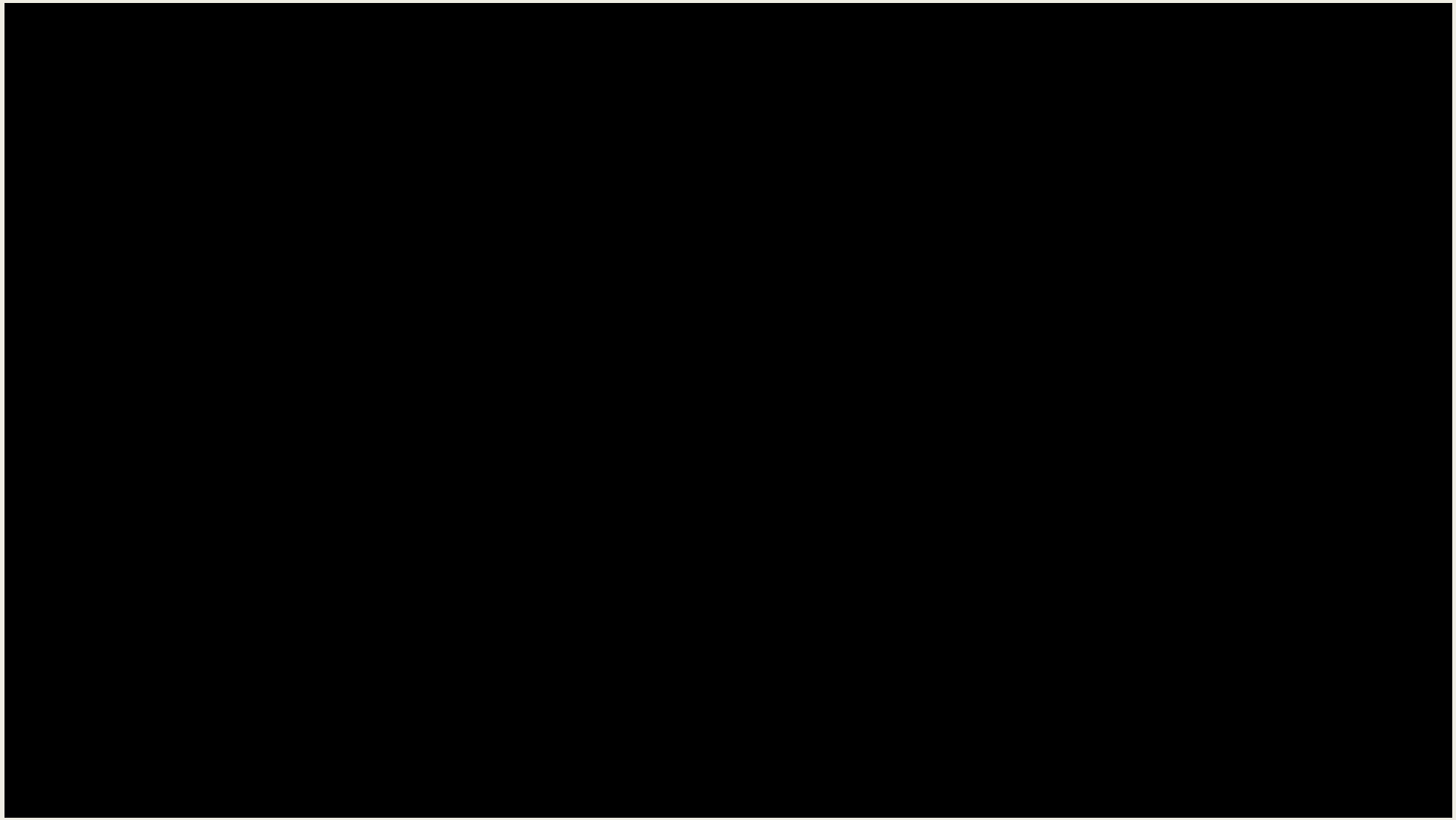
1. Screening:
   Pend_confirmation → positive
   Pen/conf → garbage

2. Screening being linked to confirmatory for stations 692 666 358

canc	Cancelled
comment	Invalid_comment
EIA POS; WB NEG	Positive screen, negative confirmatory
EIA POS; Western Blot NEG	Positive screen, negative confirmatory
EIA Positive, Western Blot Negative	Positive screen, negative confirmatory
MEG	Positive screen, negative confirmatory
N	Invalid_garbage
NEG	Positive screen, negative confirmatory
NEG OSHD	Positive screen, negative confirmatory
Negative	Positive screen, negative confirmatory
NON REACTIVE	Positive screen, negative confirmatory
NON -REACTIVE	Positive screen, negative confirmatory
Nonreactive	Positive screen, negative confirmatory
NON-REACTIVE	Positive screen, negative confirmatory
NON-RECATIVE	Positive screen, negative confirmatory
NR	Positive screen, negative confirmatory
NULL	Invalid_garbage
P	Invalid_garbage



https://www.youtube.com/watch?v=oa3YYfUDZ60

	Id	Station	file60	Testname	Comment	DataType
1	527	358	5142	OCCULT BLOOD #3	N:NEGATIVE;P:POSITIVE;U:UNSAT.SP.;I:INC.COLL.;	SET
2	85635	689	5155	NORWALK VIRUS (EM)pre 12-14-04	ANSWER MUST BE 1-10 CHARACTERS IN LENGTH	FREE TEXT
3	86139	689	5505	(WRX) PROTEIN,SERUM	S Q9="1.5,14.0,1" D ^LRNUM	NUMERIC

```
1  358-249-72-0|SENDOUT|SERUM|POINT|ng/mL|2986-8|83405.8044|358-249|SENDOUT|CHEM|CH|Number from 0 to 10000 with 2 decimal|NUMERIC|1.42|9
2  358-431-72-0|1,25-DIHYDROXYVIT D3|SERUM||PG/ML|||358-431|1,25-DIHYDROXYVIT D3||CH|ANSWER MUST BE 1-7 CHARACTERS IN LENGTH|FREE TEXT|2
3  358-1198-72-0|1/2HR LTT|SERUM|||||358-1198|1/2HR LTT||CH|ANSWER MUST BE 1-10 CHARACTERS IN LENGTH|FREE TEXT|||||NO|||O||1.1|
4  358-470-72-0|1/2Hr.GTT|SERUM|POINT|mg/dl|20439-6|81632.0000|358-470|1/2Hr.GTT|CHEM|CH|Number from 0 to 2500 with 1 decimal|NUMERIC|||
5  358-478-71-0|1/2Hr.GTT (URINE)|URINE|||||358-478|1/2Hr.GTT (URINE)||CH|Neg.:NEG;1+:1;2+:2;3+:3;4+:4;Trace:T;|SET|||||NO|||O||1.1|
6  358-237-72-0|11-DEOXYCORTISOL|SERUM||NG/ML|||358-237|11-DEOXYCORTISOL||CH|ANSWER MUST BE 0-7 CHARACTERS IN LENGTH|FREE TEXT|||||NO||C
7  358-615-71-0|17-HYDROXYCORTICOSTEROIDS|URINE||MG/24 HRS|||358-615|17-HYDROXYCORTICOSTEROIDS||CH|ANSWER MUST BE 1-6 CHARACTERS IN LENG
8  358-1199-72-0|1HR LTT|SERUM|||||358-1199|1HR LTT||CH|ANSWER MUST BE 1-10 CHARACTERS IN LENGTH|FREE TEXT|||||NO|||O||1.1|
9  358-471-72-0|1Hr.GTT|SERUM|POINT|mg/dl|20438-8|81631.0000|358-471|1Hr.GTT|CHEM|CH|Number from 0 to 2500 with 1 decimal|NUMERIC|||||NO
10 358-479-71-0|1Hr.GTT (URINE)|URINE|||||358-479|1Hr.GTT (URINE)||CH|Neg.:NEG;1+:1;2+:2;3+:3;4+:4;Trace:T;|SET|||||NO|||O||1.1|
11 358-5065-71-0|24hr Urine Protein|URINE||mgs/24 hr.|||358-5065|24hr Urine Protein||CH|Number from 0 to 9999 with 1 decimal|NUMERIC||||
12 358-392-72-0|25 OH VITAMIN D|SERUM||ng/ml|||358-392|25 OH VITAMIN D||CH|Number from 0 to 999 with 2 decimal|NUMERIC|10|55|||NO|||O||1
13 358-1200-72-0|2HR LTT|SERUM|||||358-1200|2HR LTT||CH|ANSWER MUST BE 1-10 CHARACTERS IN LENGTH|FREE TEXT|||||NO|||O||1.1|
14 358-472-72-0|2Hr.GTT|SERUM|POINT|mg/dl|20436-2|81629.0000|358-472|2Hr.GTT|CHEM|CH|Number from 0 to 2500 with 1 decimal|NUMERIC|76|115
15 358-480-71-0|2Hr.GTT (URINE)|URINE|||||358-480|2Hr.GTT (URINE)||CH|Neg.:NEG;1+:1;2+:2;3+:3;4+:4;Trace:T;|SET|||||NO|||O||1.1|
16 358-1201-72-0|3HR LTT|SERUM|||||358-1201|3HR LTT||CH|ANSWER MUST BE 1-10 CHARACTERS IN LENGTH|FREE TEXT|||||NO|||O||1.1|
17 358-473-72-0|3Hr.GTT|SERUM|POINT|mg/dl|20437-0|81163.0000|358-473|3Hr.GTT|CHEM|CH|Number from 0 to 2500 with 1 decimal|NUMERIC|||||NO
18 358-481-71-0|3Hr.GTT (URINE)|URINE|||||358-481|3Hr.GTT (URINE)||CH|Neg.:NEG;1+:1;2+:2;3+:3;4+:4;Trace:T;|SET|||||NO|||O||1.1|
19 358-474-72-0|4Hr.GTT|SERUM|POINT|mg/dl|26541-3|83001.0000|358-474|4Hr.GTT|CHEM|CH|Number from 0 to 2500 with 1 decimal|NUMERIC|||||NO
20 358-482-71-0|4Hr.GTT (URINE)|URINE|||||358-482|4Hr.GTT (URINE)||CH|Neg.:NEG;1+:1;2+:2;3+:3;4+:4;Trace:T;|SET|||||NO|||O||1.1|
21 358-202-72-0|5' NUCLEOTIDASE|SERUM||MU/ML|||358-202|5' NUCLEOTIDASE||CH|Number from 0 to 999 with 2 decimal|NUMERIC|0|15|||NO|||O||1.1
22 358-475-72-0|5Hr.GTT|SERUM|POINT|mg/dl|26543-9|83002.0000|358-475|5Hr.GTT|CHEM|CH|Number from 0 to 2500 with 1 decimal|NUMERIC|||||NO
23 358-483-71-0|5Hr.GTT (URINE)|URINE|||||358-483|5Hr.GTT (URINE)||CH|Neg.:NEG;1+:1;2+:2;3+:3;4+:4;Trace:T;|SET|||||NO|||O||1.1|
24 358-497-72-0|6Hr.GTT|SERUM|POINT|mg/dL|26544-7|81164.0000|358-497|6Hr.GTT|CHEM|CH|Number from 0 to 2500 with 0 decimal|NUMERIC|76|115
25 358-5116-70-0|ABNORM CONTROL|BLOOD||Secs|||358-5116|ABNORM CONTROL||CH|Number from 0 to 100 with 2 decimal|NUMERIC|||||NO|||O||1.1|
26 358-5117-70-0|ABNORM CONTROL INR|BLOOD|||||358-5117|ABNORM CONTROL INR||CH|Number from 0 to 100 with 2 decimal|NUMERIC|||||NO|||O||1.1
27 358-5118-70-0|ABNORM HI CTRL|BLOOD||Secs|||358-5118|ABNORM HI CTRL||CH|Number from 0 to 100 with 2 decimal|NUMERIC|||||NO||ABNORMAL HI
28 358-5119-70-0|ABNORM HI CTRL INR|BLOOD|||||358-5119|ABNORM HI CTRL INR||CH|Number from 0 to 100 with 2 decimal|NUMERIC|||||NO||ABNORMA
29 358-5224-70-0|ABO SENDOUT|BLOOD|POINT||882-1|86081.8044|358-5224|ABO SENDOUT|BANK|CH|ANSWER MUST BE 20-35 CHARACTERS IN LENGTH|FREE TE
30 358-1101-70-0|ABO/RH TYPING|BLOOD|POINT||882-1|86081.3000|358-1101|ABO/RH TYPING|BANK|CH|Group "O", Rh Positive:o+;Group "A", Rh Posit
31 358-1149-70-0|ACANTHOCYTES|BLOOD|POINT||7789-1|85061.0000|358-1149|ACANTHOCYTES|HEMA|CH|Few:F;1+:1;2+:2;3+:3;4+:4;|SET|||||NO|||O|7789
32 358-303-72-0|ACETAMINOPHEN|SERUM||ug/ml|||358-303|ACETAMINOPHEN||CH|ANSWER MUST BE 1-7 CHARACTERS IN LENGTH|FREE TEXT|0|30|5|20|NO|||C
33 358-193-71-0|ACETONE|URINE|||||358-193|ACETONE||CH|ANSWER MUST BE 0-7 CHARACTERS IN LENGTH|FREE TEXT|||||NO|||O||1.1|
```

RETROSPECTIVE RESULT STANDARDIZATION

Standardization of CDW laboratory results

Appendix Table 3: Examples of Standardized Results. The output of this table closely mimics the output of the tool. Table 1 in the main text describes the schema of this table. The "AfterDecimal" column indicates the number of decimal places included after the decimal. The "Field1" and "Field2" column represent important conversions or descriptions, which vary depending on the map function (Supplementary Table 1). The "General" column contains generic results applicable to any laboratory test (e.g., cancelled). The "Pretty" column represents a human-readable format for reports.

TestId	Result	TestScale	MappedYN	MapFunc	Inequality	Number	AfterDecimal	Field1	Field2	General	Pretty
30894-0	TNP	Quantitative	Y	General						Not Performed	Not Performed
6090-5	QNS	Quantitative	Y	General						Not Performed	Not Performed
2064-4	comment	Quantitative	Y	General						Non-standard Result	Non-standard Result
14914-6	canc	Quantitative	Y	General						Not Performed	Not Performed
32286-7	Type 1	Nominal	Y	HepCGenotype				HepatitisCGenotype:1			1
32286-7	1, NO SUBTYPE	Nominal	Y	HepCGenotype				HepatitisCGenotype:1			1
32286-7	HCV 1	Nominal	Y	HepCGenotype				HepatitisCGenotype:1			1
32286-7	TYPE 1 Unable to subtype	Nominal	Y	HepCGenotype				HepatitisCGenotype:1			1
14664-7	DK YELLOW	Nominal	Y	Nom				Dark Yellow	Group:Color		Dark Yellow
5778-6	LTBRN	Nominal	Y	Nom				Light Brown	Group:Color		Light Brown
882-1	0 POSITIVE	Nominal	Y	Nom_AboRh				O Positive	Group:ABO		O Positive
882-1	O POSITIVE	Nominal	Y	Nom_AboRh				O Positive	Group:ABO		O Positive
21009-6	POS	Nominal	Y	Ord				Pos	Group:Binary		Pos
35707-9	Detected	Quantitative	Y	Ord				Pos	Group:Binary		Pos
7905-3	POSTIVE	Ordinal	Y	Ord				Pos	Group:Binary		Pos
Missing	POSITIVE	*Missing*	Y	Ord				Pos	Group:Binary		Pos
25156-1	3%	Ordinal	Y	Qn		3	0		Suffix '%'		3
8067-1	<=12	Quantitative	Y	Qn	<=	12	0				<=12
14959-1	932.87	Quantitative	Y	Qn		932.87	2				932.87
6020-2	<.35 KU/L (%ASM:93)	Quantitative	Y	Qn_IgEAb	<	0.35	2	93			0.35
6092-1	>100 KU/L(%ASM:3466)	Quantitative	Y	Qn_IgEAb	>	100	0	3466			100
30170-5	>.35kU/L, %ASM:15	Quantitative	Y	Qn_IgEAb	>	0.35	2	15			0.35
21008-8	1.8 LOG10	Quantitative	Y	Qn_Log10		63	1	Log10:1.8			1.8
29615-2	>10,000 COPIES/ML	Quantitative	Y	Qn_RemoveUnitsEnd	>	10000	0	Unit: {copies}/mL			10000
Missing	<0.3 U/L	*Missing*	Y	Qn_RemoveUnitsEnd	<	0.3	1	Unit: U/L			0.3

Table 2: The Laboratory Result Standardization Process. Metrics A and B always represent groups defined by the total number of results, rather than the distinct number of results[3].

Total Results	1,266,349,351	
Total Results Standardized[1]	1,252,109,700	98.9%
Total Results Not Standardized	14,239,651	1.1%
A: Result appears less than five times[3]	13,230,159	1.0%
B: LOINC code with less than 100 results[3]	4,130	0.0%
C: Missing LOINC code	1,651,448	0.1%
Not A, B, or C	762,336	0.1%
Total Distinct Results	2,682,196	
Total Distinct Results Standardized[2]	2,603,309	97.1%
Total Distinct Results Not Standardized	78,887	2.9%
A: Result appears less than five times[3]	75,385	2.8%
B: LOINC code with less than 100 results[3]	1,476	0.1%
C: Missing LOINC code	36,958	1.4%
Not A, B, or C	1,622	0.1%

[1]Concept token coverage; [2]Concept type coverage; [3]Relative to the total results

Binary Map

```
NNEGATIVE   Neg
NOT CONFIRMED   Neg
NOT CON Neg
NOT CONF    Neg
NOT CONFIRM Neg
NOT CONFRIMED   Neg
NOT DONFIRMED   Neg
NOTCON  Neg
NOTCONF Neg
NEGATI  Neg
negativ e   Neg
poc negative    Neg
NNREAC  Neg
NON REACT   Neg
NON_REACTIVE    Neg
NONREA  Neg
NONREAC Neg
NON-REAC    Neg
NON-REACITVE    Neg
NONREACT    Neg
NON-REACT   Neg
nonreact.   Neg
NON-REACT.  Neg
NON-REACTIVE'   Neg
NON-REATIVE Neg
NONREAVTIVE Neg
NON-RECTIVE Neg
NONTEACTIVE Neg
NOREACTIVE  Neg
NotReactive Neg
N-REACTIVE  Neg
CONFIRMEDNEGATIVE   Neg
NEG'    Neg
NEGNEG  Neg
NoDetected  Neg
Non-Det Neg
NON-DETECTED    Neg
NONE_DETECTED   Neg
NONE-DECTECTED  Neg
NONE-DEDECTED   Neg
```

```
Indetermnt  Indet
INDET.  Indet
INDETERMINATE H Indet
INDETERMINAT    Indet
INDTERM Indet
INTERMINATE Indet
INDETERMINATE H*    Indet
INDERTERM.  Indet
WEAK POSITIVE   Indet
Weak    Indet
Equivocal   Indet
 EQUIVOCAL  Indet
EQIV    Indet
EQUIV.  Indet
Equivical   Indet
EQUIVO  Indet
EQUIVOC Indet
EQUIVOCA    Indet
EQUVL   Indet
 INDETERMINATE  Indet
BDL Indet
BDRLINE Indet
BODERLINE   Indet
BOR Indet
BORDERL Indet
BORDERLIN   Indet
BORDERLINE  Indet
BORDERLINE POS  Indet
BORDERLINE POS. Indet
BORDERLINE POSITIVE Indet
BORDERLING  Indet
BORDRELINE  Indet
BRDLN   Indet
BRDLNE  Indet
BRDRLNE Indet
EOUIVOCAL   Indet
```

```
CLOSTRIDIUM DIFFICILE TOXIN A POSITIVE  Pos
POSITIVIE   Pos
RPT REACT   Pos
POSITIVE    Pos
Present Pos
ABNORMAL    Pos
Immune  Pos
POS Pos
Positive for H. pylori Antigen  Pos
 POS    Pos
 POS.   Pos
Pos:    Pos
***POS  Pos
**POS   Pos
**POSITIVE  Pos
POS SEE COMMENT Pos
DETECTED    Pos
[POSITIVE   Pos
CONFIRMED   Pos
CONF    Pos
CONFIR  Pos
CONFIRM Pos
CONFIRMED'  Pos
CONFRMD Pos
CON POS Pos
CONFIRMED POSITIVE  Pos
CONFIRMEDPOSITIVE   Pos
CONPOS  Pos
SCRNPOS Pos
SCRNPOIS    Pos
SCRN-POS    Pos
SCRNPOSITIVE    Pos
SCRPOS  Pos
SCRPOSITIVE Pos
SRCNPOS Pos
SRNPOS  Pos
P[OS    Pos
P[OSITIVE   Pos
P0S Pos
PODITIVE    Pos
```

Hepatitis C Map

```
HEPATITIS C VIRUS GENOTYPE 1B IS DETECTED   1b
Subtype 2a/2c   2a, 2c
TYPE2a/2c   2a, 2c
1A/2B   1a, 2b
2c  2c
TYPE2Unabletosubtype    2
GENOTYPE 3  3
Genotype2b  2
Type 2a OR 2c   2a, 2c
1a  1a
1a \T\ 1b   1a, 1b
Type 4c/4d  4c, 4d
1a/b    1a, 1b
1,1b    1b
1 NOSUBTYPE 1
GENOTYPE 2a OR 2c   2a, 2c
1NOSUBTYPE  1
2 b 2b
1a,1b   1a, 1b
3 ONLY  3
HEPATITIS C VIRUS GENOTYPE 2B IS DETECTED   2b
1UNABLETOSUBTYPE    1
TYPE 4 UNABLE TO SUBTYPE    4
2 ns    2
6   6
TYPE 2a 2a
HEPATITIS C VIRUS GENOTYPE 3 IS DETECTED    3
1b/2b   1b, 2b
1c  1c
1&4 1, 4
2(unable to subtype)    2
4 unable to subtype 4
3c  3c
Subtype 2a  2a
1a and 4    1a, 4
1a and 1b   1a, 1b
3d  3d
Subtype1a/1b    1a, 1b
1,b 1b
1&2 1, 2
```

```
1a variant  1a
4c/4d   4c, 4d
4a/4c/4d    4a, 4c, 4d
1 1b    1b
 1b 1b
Type3a  3a
Genotype 2  2
Type2   2
GENOTYPE1A  1a
Subtype 2b  2b
1(NO SUBTYPE)   1
2a or 2c    2a, 2c
Genotype1b  1b
1(UNABLE TO SUBTYPE)    1
HCV 2   2
Subtype3a   3a
2 NO SUBTYPE    2
Subtype 3a  3a
2 (NO SUBTYPE)  2
TYPE1Unabletosubtype    1
4a  4a
2a/c    2a, 2c
3 no subtype    3
  2b    2b
1,NO SUBTYPE    1
1(NOSUBTYPE)    1
TYPE2b  2b
HEPATITIS C VIRUS GENOTYPE 1A IS DETECTED   1a
Subtype2b   2b
2 UNABLE TO SUBTYPE 2
  3a    3a
1 a 1a
TARGET NOT AMPLIFIED None
GENOTYPE 2A/2C  2a, 2c
TYPE 3 Unable to subtype    3
 2b 2b
```

```
TYPE 1a 1a
TYPE 1b 1b
2b  2b
3a  3a
Type 1  1
GENOTYPE 1a 1a
Type 2b 2b
GENOTYPE 1b 1b
Type 2  2
TYPE 3a 3a
HCV 1   1
HCV 3   3
1a/1b   1a, 1b
TYPE 3  3
2a/2c   2a, 2c
GENOTYPE 2b 2b
TYPE1B  1b
TYPE1a  1a
TYPE1   1
Genotype 3a 3a
  1a    1a
TYPE 1a/1b  1a, 1b
1 1a    1a
Subtype 1a  1a
1 (NO SUBTYPE)  1
1 UNABLE TO SUBTYPE 1
Subtype1a   1a
 1a 1a
  1b    1b
1a or 1b    1a, 1b
1 NO SUBTYPE    1
TYPE 2a/2c  2a, 2c
2a  2a
Subtype 1b  1b
GENOTYPE 1  1
TYPE 1 Unable to subtype    1
Subtype1b   1b
1, NO SUBTYPE   1
TYPE 4  4
```

PROSPECTIVE RESULT STANDARDIZATION

Interacting with Sta3ns to standardize laboratory reports

From: Icardi, Michael S.
Sent: Wednesday, July 06, 2016 3:21 PM
To: Hauser, Ronald
Cc: Miller, Valerie
Subject: Presentation next PLMS meeting

Dr. Hauser,
Would you be able to present your standardization initiative on the national P&LMS call on the 19th? The call is at 1:00 pm EST and would be for about 15-20 mins. I would like you to generate some additional exposure for it.

Thanks,

Michael S. Icardi MD
National Director of Pathology and Laboratory Medicine Services
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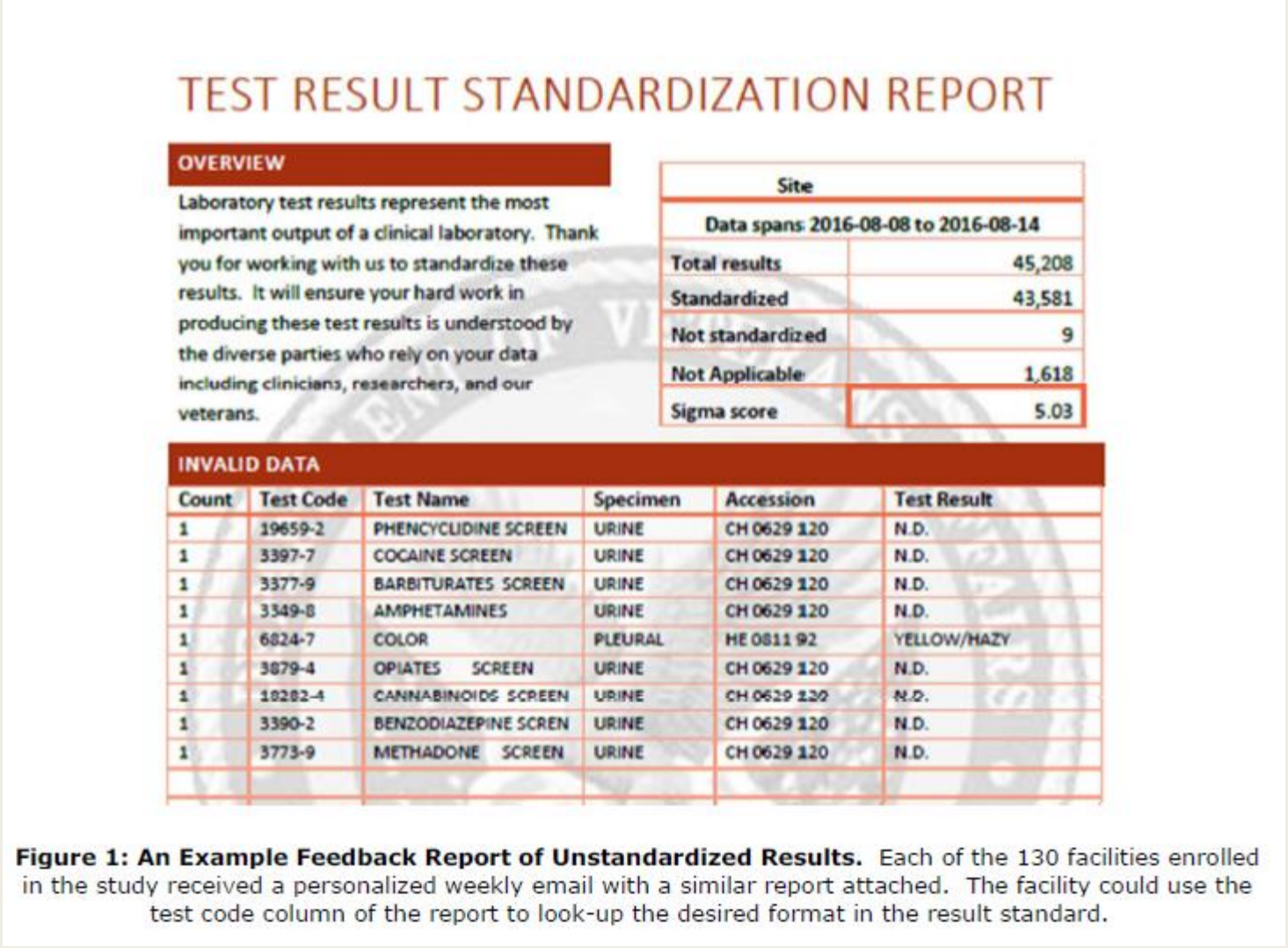
36	526	Gerard	Gerard.Famby@va.gov

Prospective Results

Emailed Customized Reports



TEST RESULT STANDARDIZATION REPORT

OVERVIEW

Laboratory test results represent the most important output of a clinical laboratory. Thank you for working with us to standardize these results. It will ensure your hard work in producing these test results is understood by the diverse parties who rely on your data including clinicians, researchers, and our veterans.

Site	
Data spans: 2016-08-08 to 2016-08-14	
Total results	45,208
Standardized	43,581
Not standardized	9
Not Applicable	1,618
Sigma score	5.03

INVALID DATA

Count	Test Code	Test Name	Specimen	Accession	Test Result
1	19659-2	PHENCYCLIDINE SCREEN	URINE	CH 0629 120	N.D.
1	3397-7	COCAINE SCREEN	URINE	CH 0629 120	N.D.
1	3377-9	BARBITURATES SCREEN	URINE	CH 0629 120	N.D.
1	3349-8	AMPHETAMINES	URINE	CH 0629 120	N.D.
1	6824-7	COLOR	PLEURAL	HE 0811 92	YELLOW/HAZY
1	3879-4	OPIATES SCREEN	URINE	CH 0629 120	N.D.
1	18282-4	CANNABINOIDS SCREEN	URINE	CH 0629 120	N.D.
1	3390-2	BENZODIAZEPINE SCREN	URINE	CH 0629 120	N.D.
1	3773-9	METHADONE SCREEN	URINE	CH 0629 120	N.D.

Figure 1: An Example Feedback Report of Unstandardized Results. Each of the 130 facilities enrolled in the study received a personalized weekly email with a similar report attached. The facility could use the test code column of the report to look-up the desired format in the result standard.

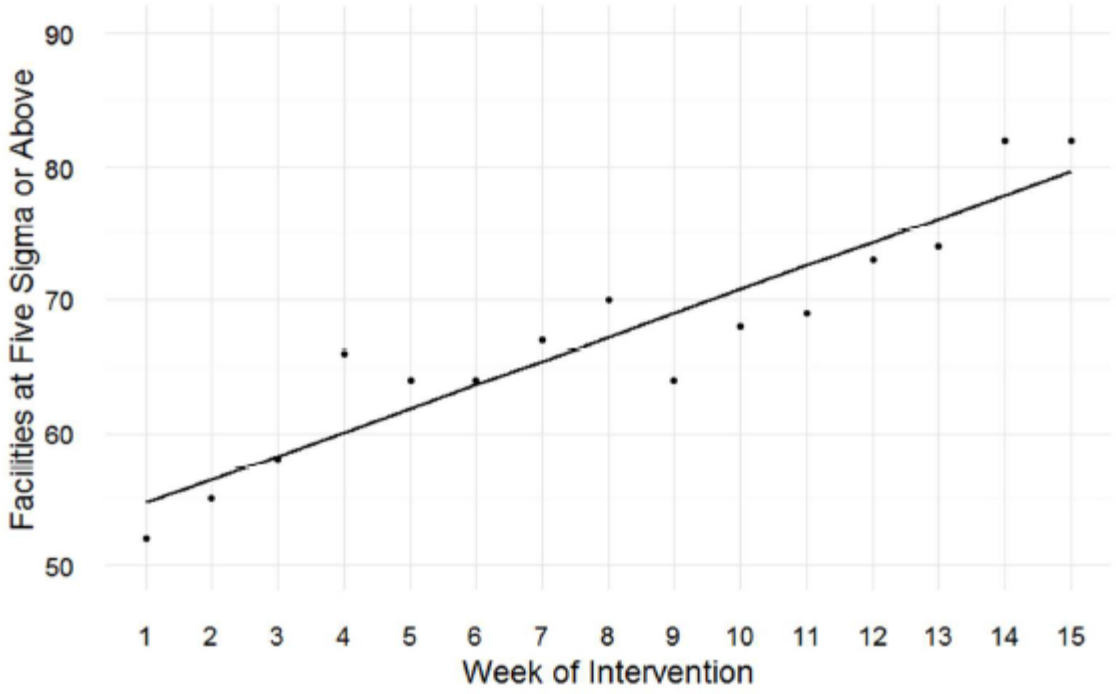


Figure 3: Facilities at Five Sigma or Above by Week of Intervention. Facilities at five sigma or above have 23 or fewer unstandardized results per 100,000 test results. Tests not reviewed were excluded from the calculation. The line represents a linear regression. A total of 130 facilities participated.

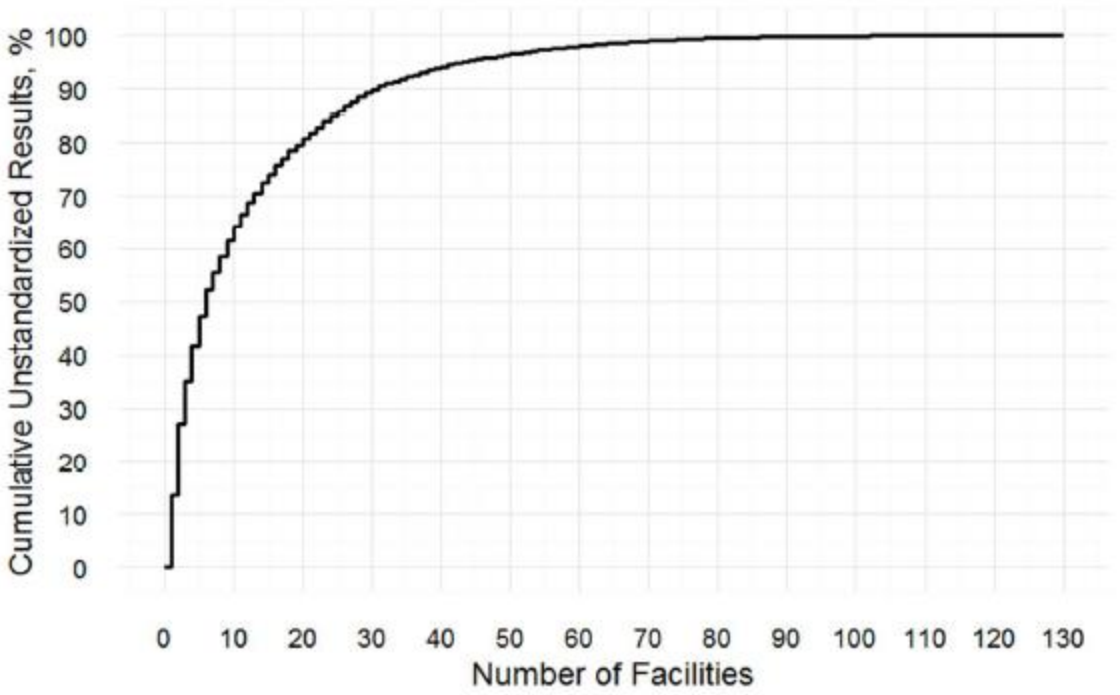


Figure 4: Few Facilities Contributed Many Unstandardized Results. For example, six facilities contributed over 50% of unstandardized results. The plot represents the last week of the intervention, week 15. A total of 130 facilities participated.

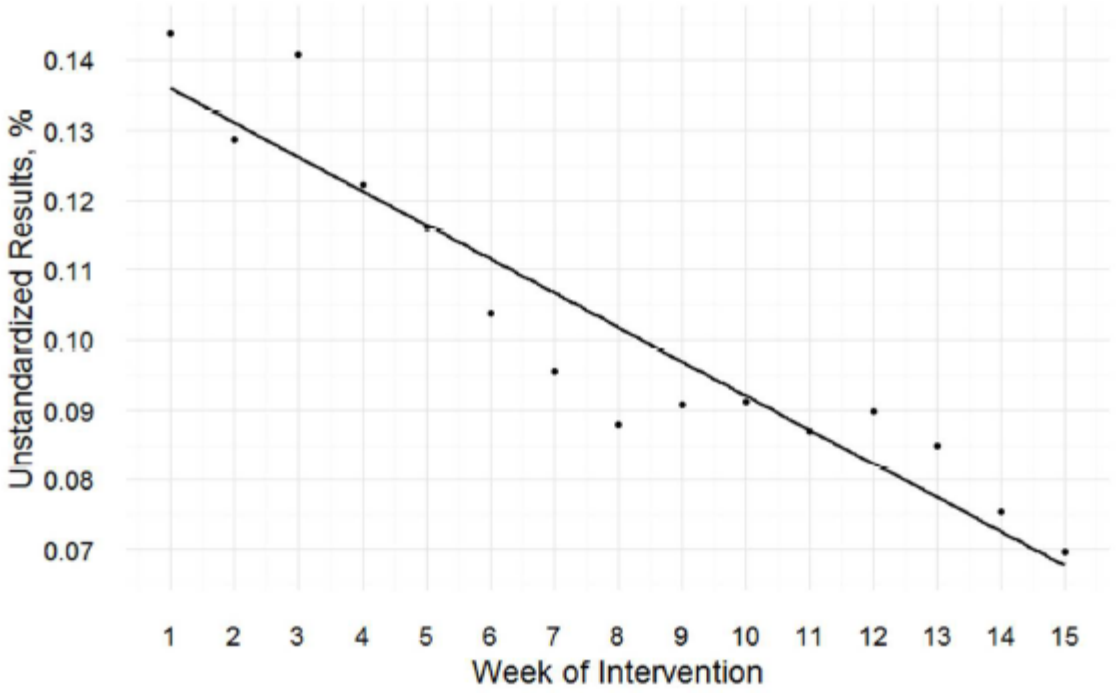
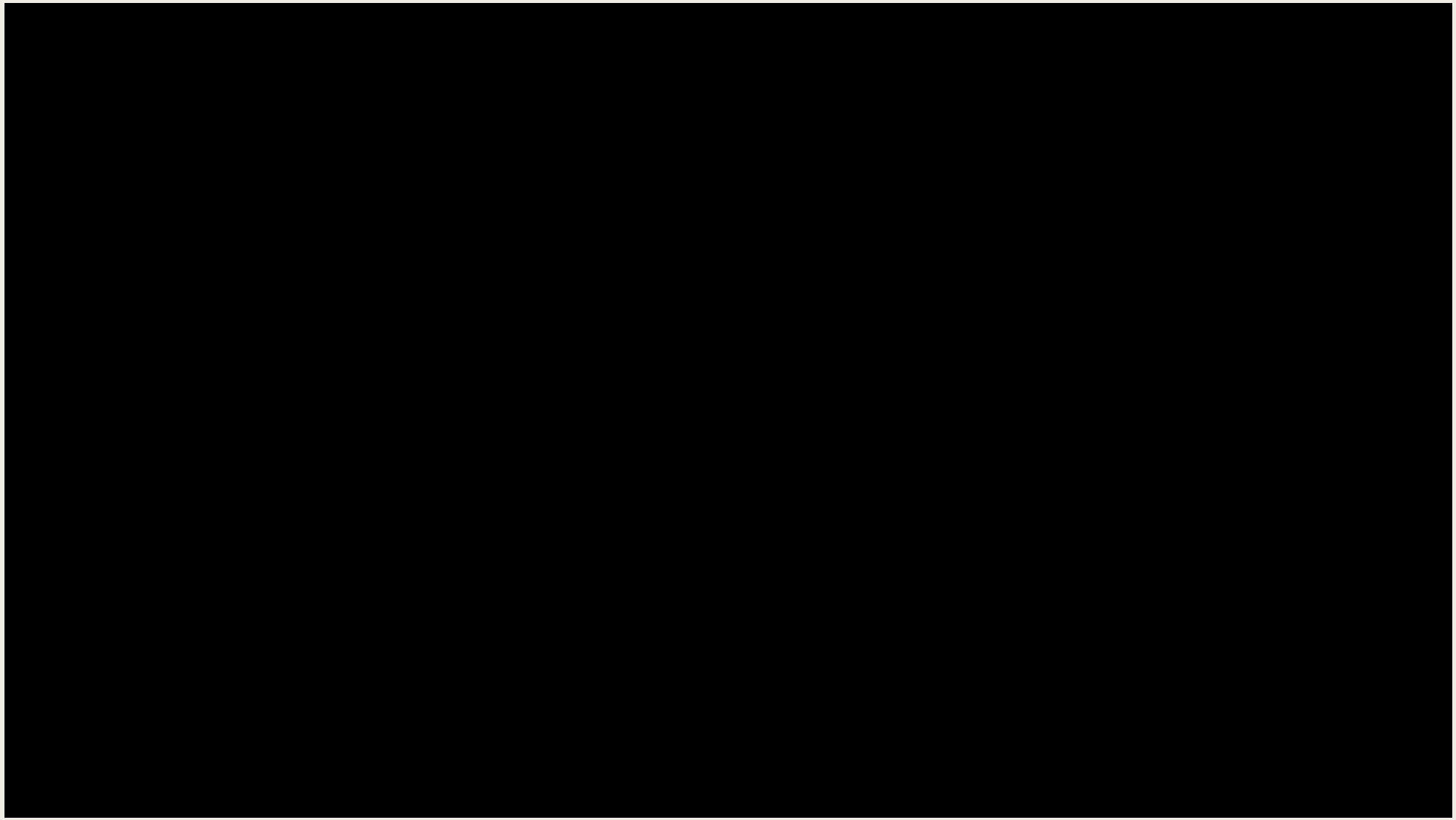


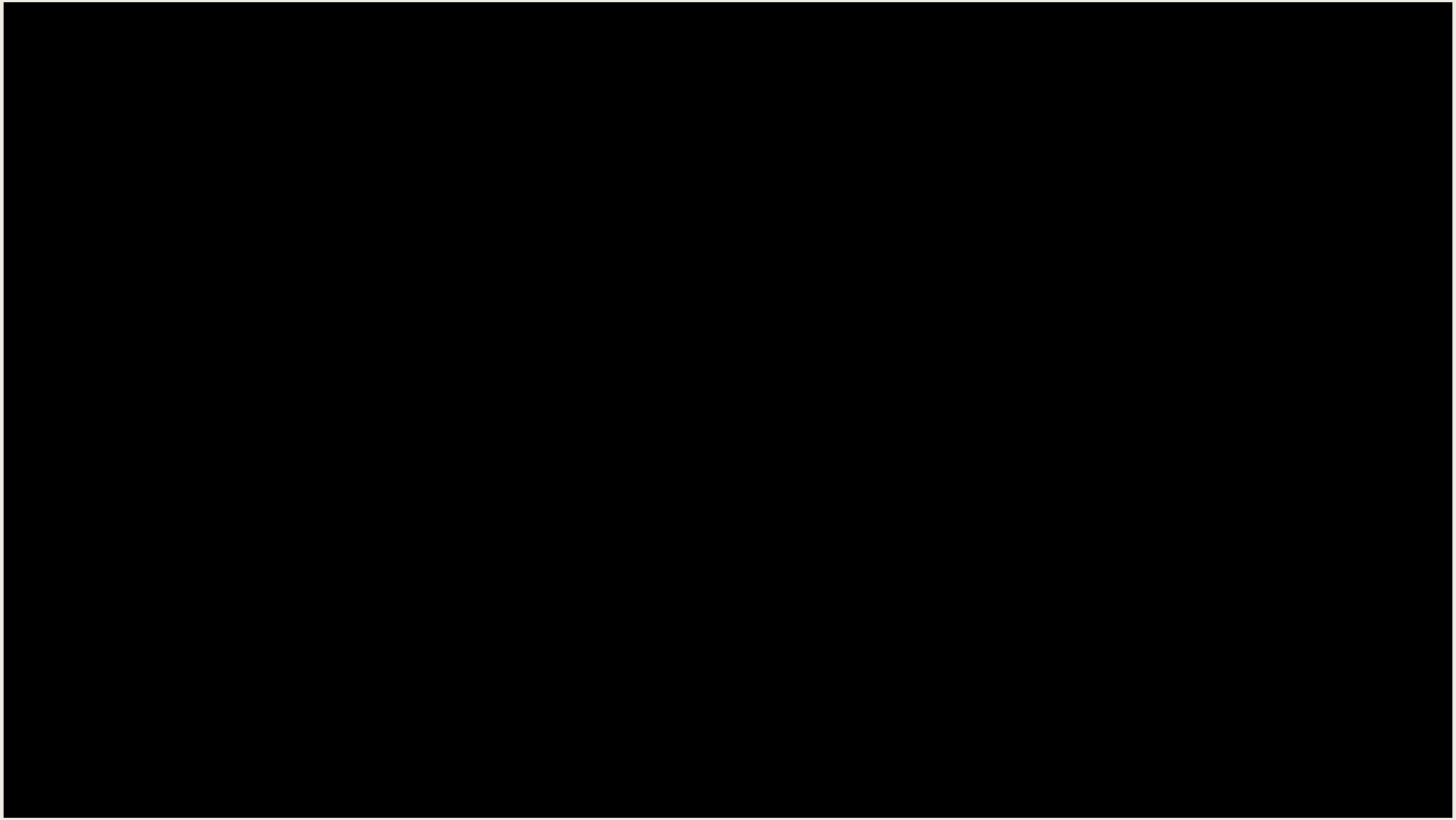
Figure 2: Percent of Unstandardized Test Results by Week of Intervention. Each point represents the percent of weekly unstandardized results to the total reviewed results. Each week approximately 10.4 x 106 test results were reviewed. The line represents a linear regression.

TEST CODE ASSIGNMENT

Assignment of LOINC codes



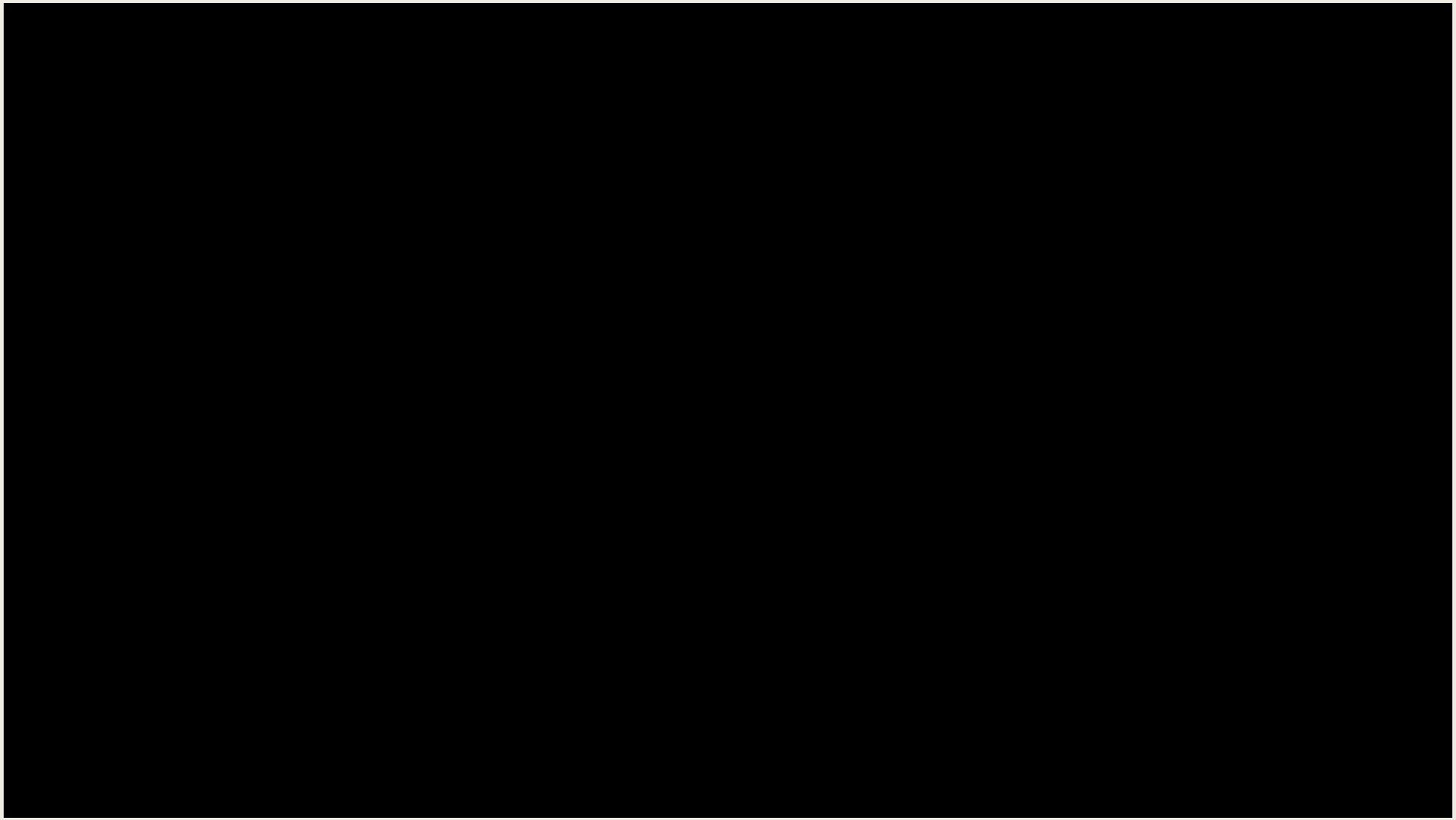
Assign By Name



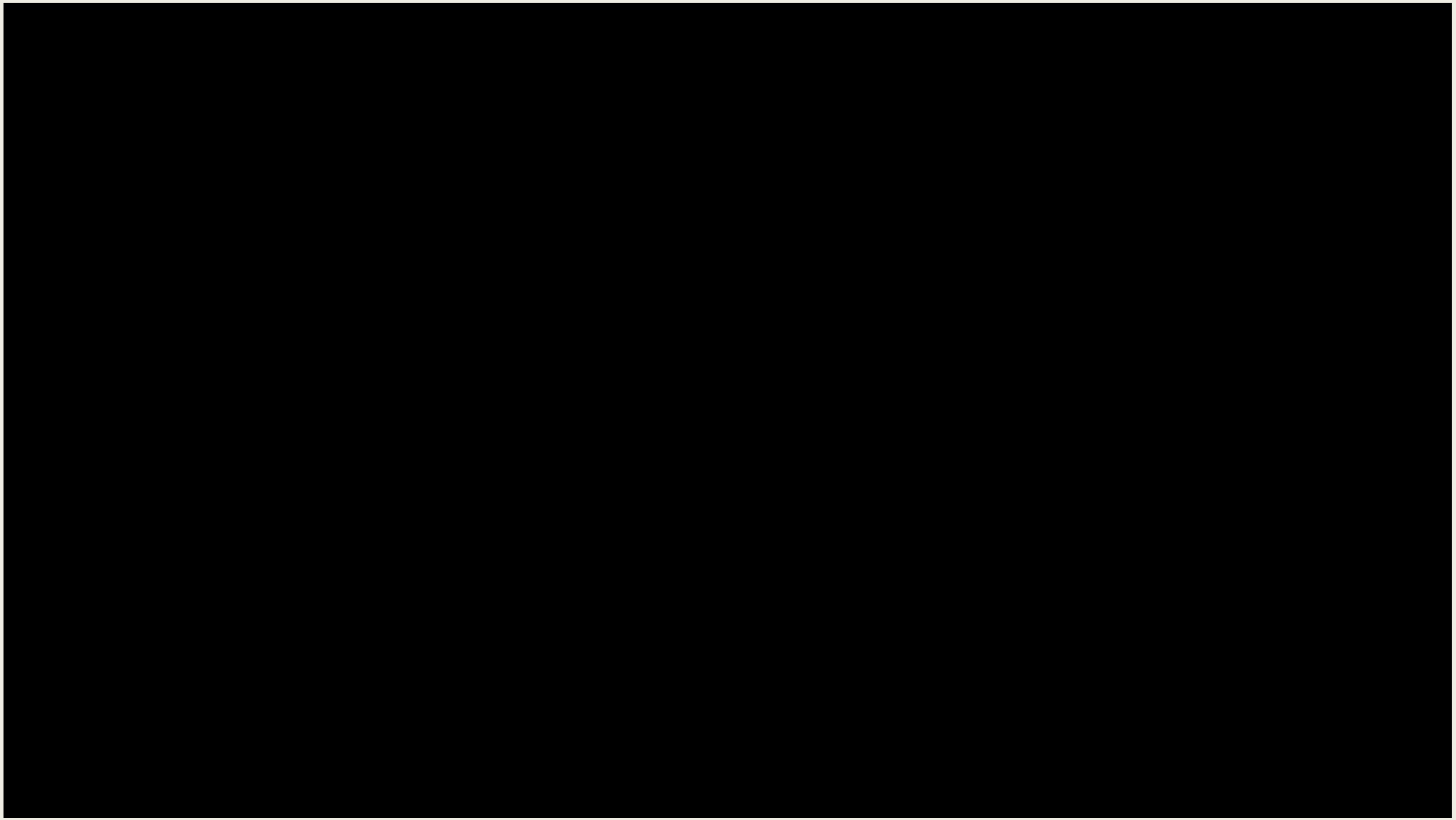
Assignment Scorecard

TEST CODE ASSIGNMENT – QUALITY CONTROL

Statistical evaluations of laboratory tests and results



Assignment Progress Report



Quality Control and Export

LOINC HIERARCHY

Tools to aide LOINC code retrieval

Gallery

The Benchmark Hierarchies

Identify groups of clinically similar LOINC codes to benchmark laboratory test utilization.

View Benchmark All Hierarchy (Download Groups)

View Benchmark Common Hierarchy (Download Groups)

The Methodless Hierarchy

Identify LOINC codes irrespective of the test performance method.

View Methodless Hierarchy (Download Groups)

The Common Test Hierarchy

Quickly browse the most common LOINC codes[1].

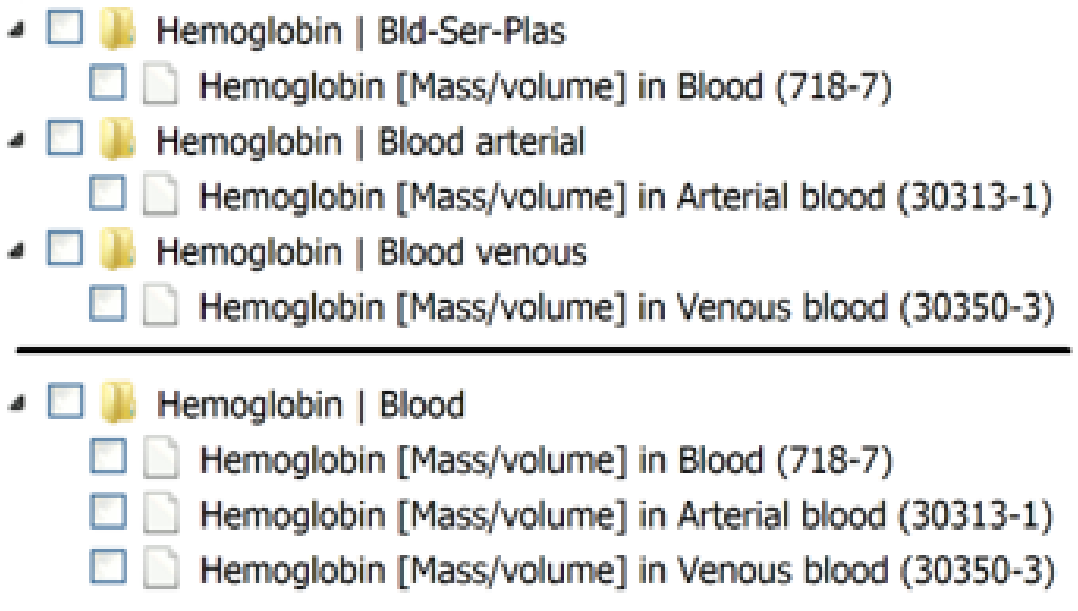
View Common Test Hierarchy (Download Groups)

Table 2. Comparison of the Groups Created by Different Hierarchies for Carbon Dioxide. The patterns correspond to groups within each hierarchy. Blank cells indicate the hierarchy does not include the LOINC. Ranked tests represent commonly performed tests.

LOINC	Name	Ranked	Control[1]	Common[2]	Method[3]	BM-Common[4]	BM-All[5]
34705-4	Carbon dioxide [Partial pressure] in Blood adjusted to patient's temperature	Yes					
11557-6	Carbon dioxide [Partial pressure] in Blood	Yes					
20565-8	Carbon dioxide, total [Moles/volume] in Blood	Yes					
2028-9	Carbon dioxide, total [Moles/volume] in Serum or Plasma	Yes					
57922-7	Carbon dioxide, total [Moles/volume] in Serum or Plasma by calculation	No					
34728-6	Carbon dioxide, total [Moles/volume] in Blood by calculation	No					
77143-6	Carbon dioxide, total [Moles/volume] in Serum, Plasma or Blood	No					
74684-2	Carbon dioxide, total [Moles/volume] in Serum or Plasma --post dialysis	No					

[1]Multi-Axial Hierarchy, [2]Common Test Hierarchy, [3]Methodless Hierarchy, [4]Benchmark Hierarchy - Common, [5]Benchmark Hierarchy - All

Figure 2. Hierarchy modification via the online tool. (Upper left) The MAH separates hemoglobin in blood, arterial blood, and venous blood. (Right) But, hemoglobin has a comparable physiologic range in in sample data. (Bottom left) The hierarchy can be manipulated to rearrange the groups.



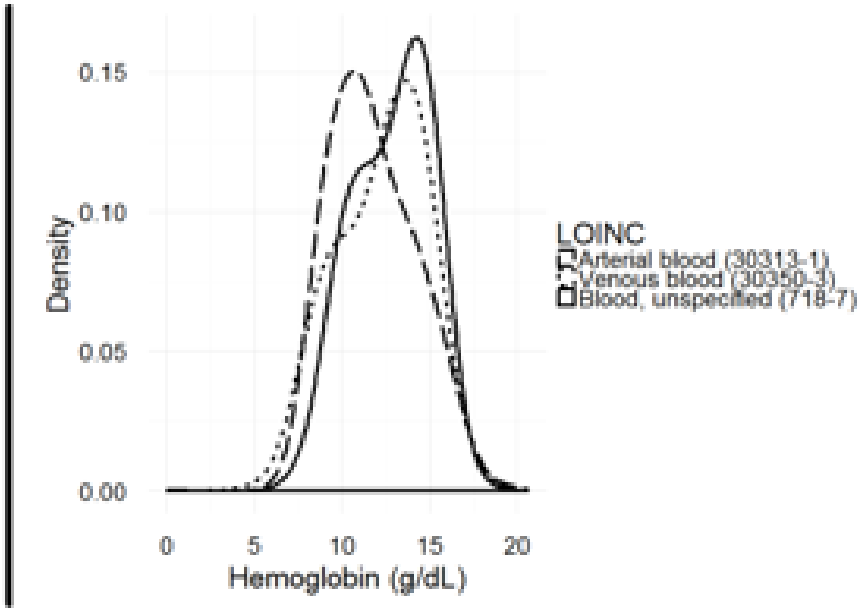
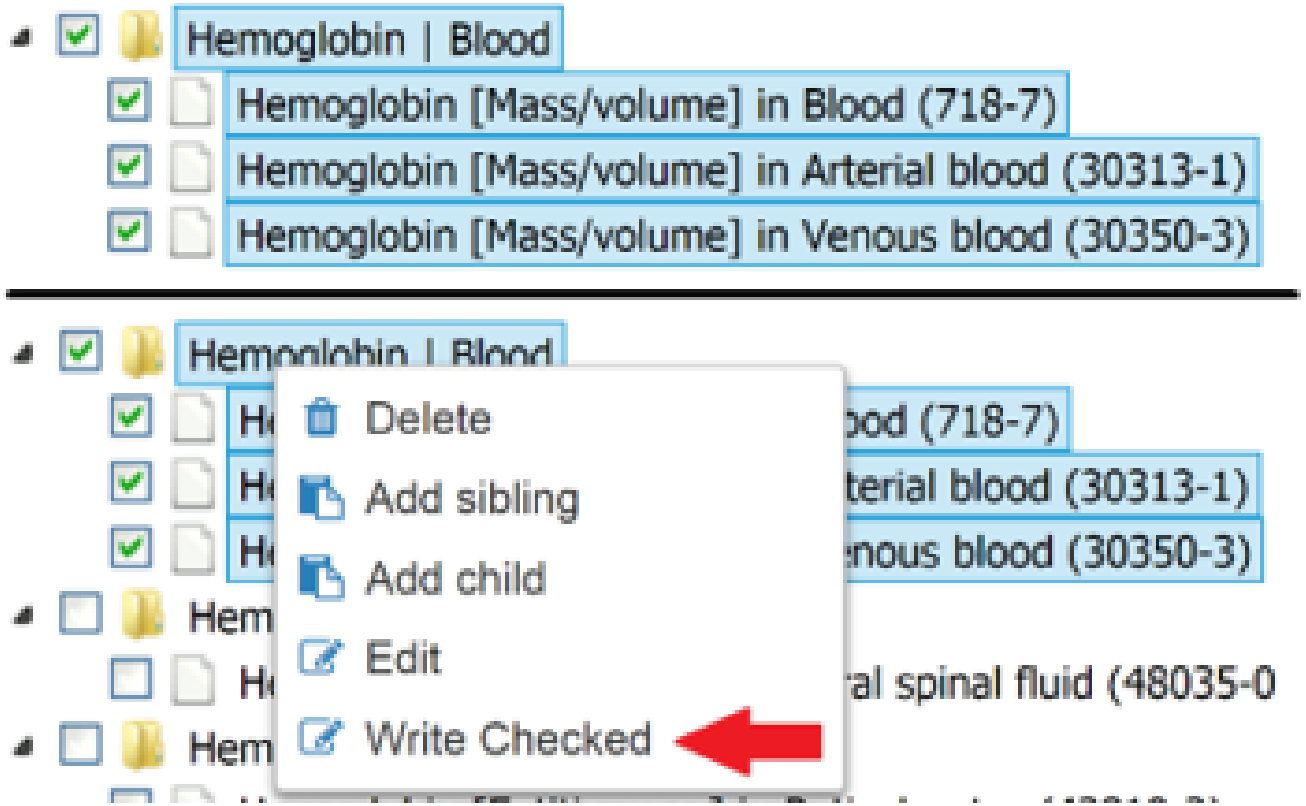


Figure 3. Retrieval of LOINC hematocrit codes via the online tool. (Top) A click on the parent checkbox adjacent to "Hemoglobin | Blood" will activate the checkbox of all the children. (Bottom) A right-click on a node will create a menu with an option "Write Checked" to export the LOINC codes with a check.



LOINC UNITS

Merge LOINC codes with interconvertible results

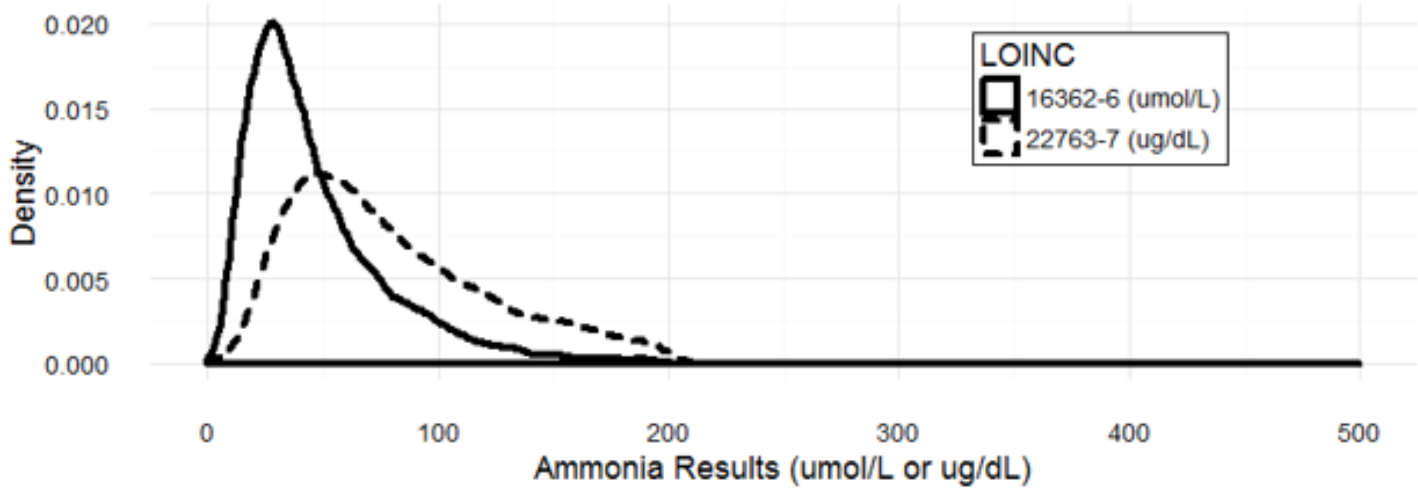


Figure 1: Ammonia results reported in either micromoles per liter or micrograms per deciliter (top) then converted to a single unit, micrograms per deciliter (bottom).

LOINC Codes

16362-6	Ammonia [Moles/volume] in Plasma
22763-7	Ammonia [Mass/volume] in Plasma

Conversion

$$\frac{ug}{dL}\left(\frac{10\ dL}{L}\right)\left(\frac{umol}{17.03\ ug}\right)=\left(\frac{1}{1.703}\right)\frac{umol}{L}$$

Final Result

[16362-6] = [22763-7]/1.703

Reference

Molecular weight of ammonia = 17.031 g/mol.

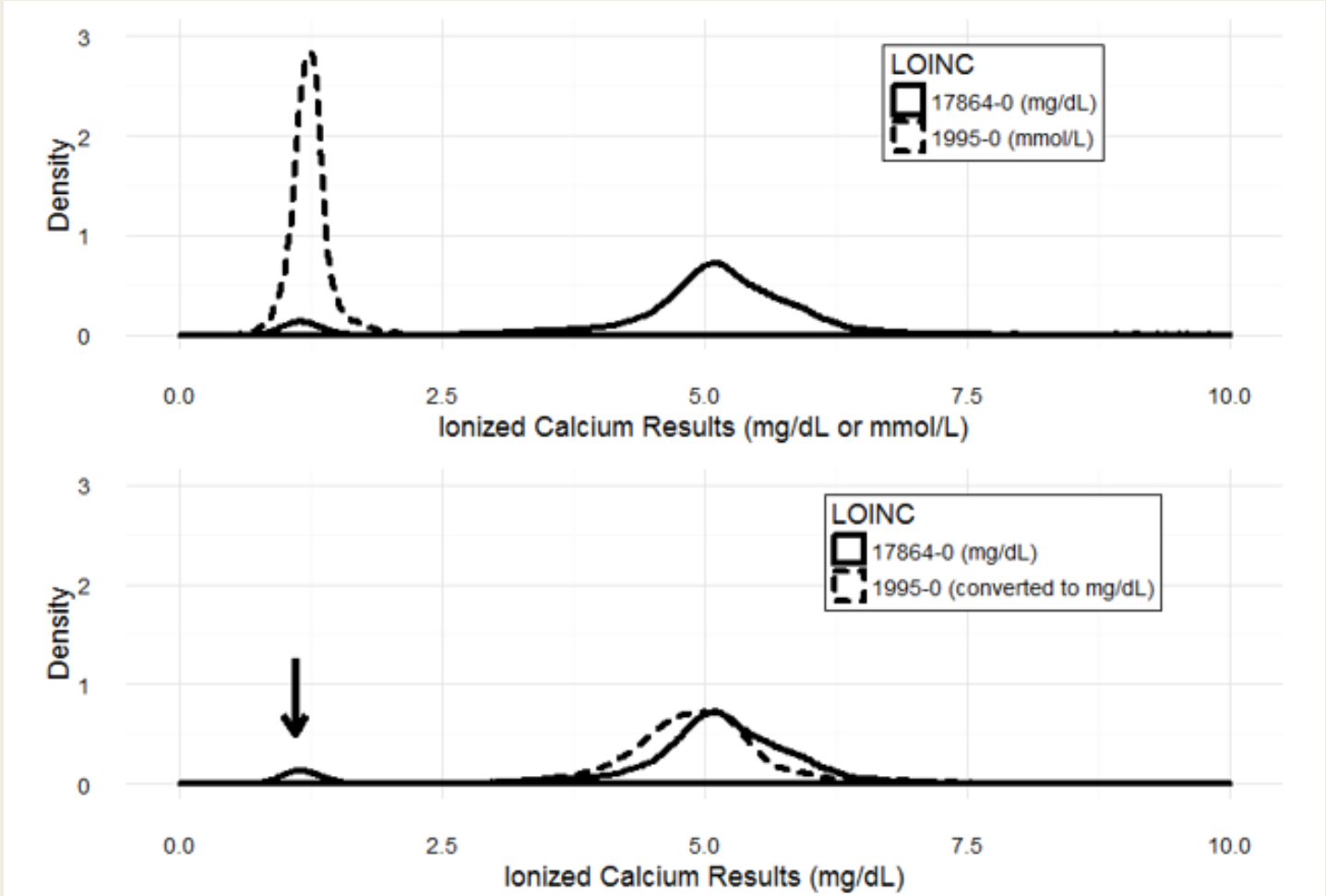


Figure 2: Ionized calcium results reported in either milligrams per deciliter or millimoles per liter (top) then converted to a single unit, milligrams per deciliter (bottom). The arrow indicates laboratory test results erroneously reported in millimoles per liter instead of the expected units of milligrams per deciliter.

“OUTBOX”

Access to standardized tests and results on the CDW

Live Examples

- Monitoring laboratory test designations in near-real time
- Mapping laboratory results in near-real time

CONCLUSION

Projects

Topic	Description
Results	“Set of codes” – An issue with CDW data extraction
	“Retrospective” - Standardization of CDW laboratory results
	“Prospective” – Interacting with Sta3ns to standardize laboratory reports
Tests	“Identifiers” – LOINC code assignments
	“Quality Control” – statistical evaluations of laboratory tests and results
LOINC	“Hierarchy” – LOINC code looks for assignment and retrieval
	“Units” – Interconversion of LOINC codes with different units
Outbox	“Outbox” – Access to standardized tests and results on the CDW