Connecticut Newborn Screening For X-Linked Adrenoleukodystrophy

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CT Newborn Screening

► CGS 19a-55 mandates screening of all CT newborns for select genetic and metabolic disorders

► The CT State Lab screens for 64 disorders including AA, OA, Urea Cycle, FAO, hemoglobin production, endocrine disorders, autoimmune & peroxisomal disorders

► 37,242 births in 2016

► 99.89% newborns screened

► CF Screening conducted at UCONN and Yale Laboratories

► DPH Family Health Section oversees hearing screening, CCHD screening and birth defect registry

Connecticut NBS Timeline

1964	1979	1983	1995	05/2004	09/2004	11/2004	01/2005	09/2010	10/2011	07/2016
• PKU	• CH • GALT	• MSUD • HCY • BIO • HGB S • HGB SC • Hgb C • Hgb SD • Hgb D • Hgb SE • Hgb E • Hgb Bart's • Hgb Sβ° Thal • Variant Hg	• CAH	• MSUD • HCY • MET • TYR • MCAD • LCHAD • VLCAD • TFP	• CPT1 • GAII • CPTII • CACT • CUD	• PPA • MMA • IVA • HMG • 3MCC • MCD • GA I • ßKT	• ARG • CIT • ASA • OTC • SCAD • DE RED • MMA • HHH* • NKH*	• M/SCAD • IBG • EME • FIGLU • 2MBG • 2M3HBA • 3MGA • CPS • PC • RMD • PHE • BIOPT (REG) • BIOPT (BS)	• SCID • T-Cell Lymph openia	• X-ALD

*removed 2016

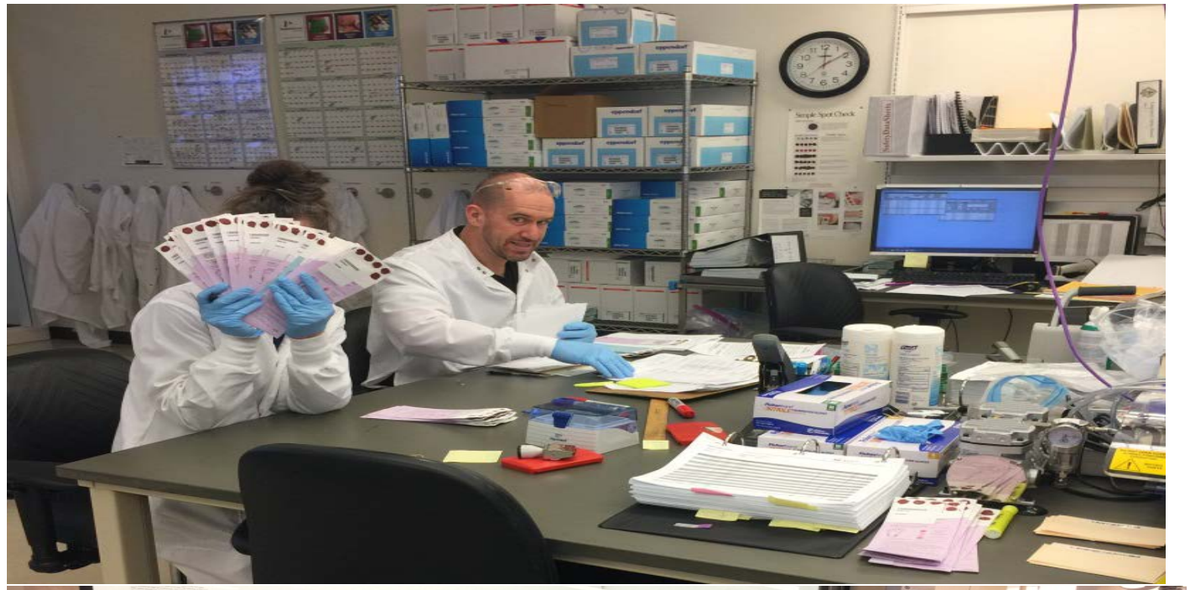
CT Newborn Screening

Short Term Follow-Up and Tracking

Responsibilities:

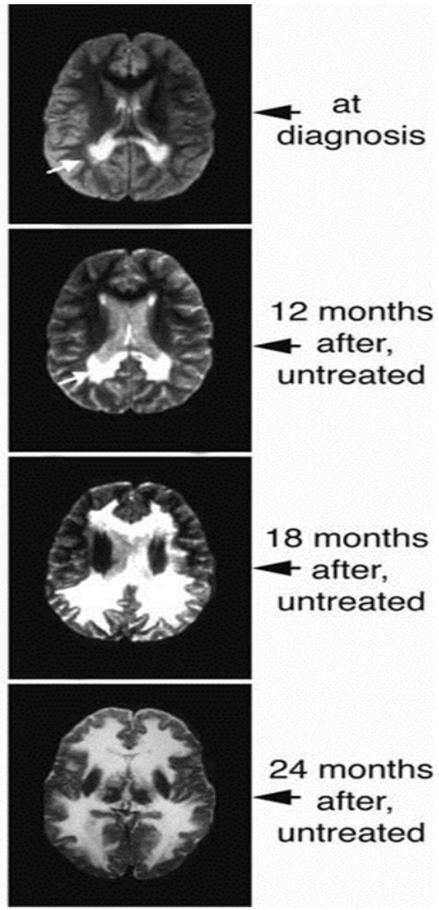
- Using the NBS database, assuring that all infants are screened
- Reporting abnormal results and
  - Requesting a repeat NBS specimen or
  - Referring to a regional diagnostic/treatment center
- Following up through diagnosis or exclusion of a disorder
- Maintaining and reporting of statistics
- Educating stakeholders
- Maintaining and trouble shooting the NBS database
- Collaborating with and supporting hospital and birthing center staff, diagnostic/ treatment center staff, primary care providers and parents

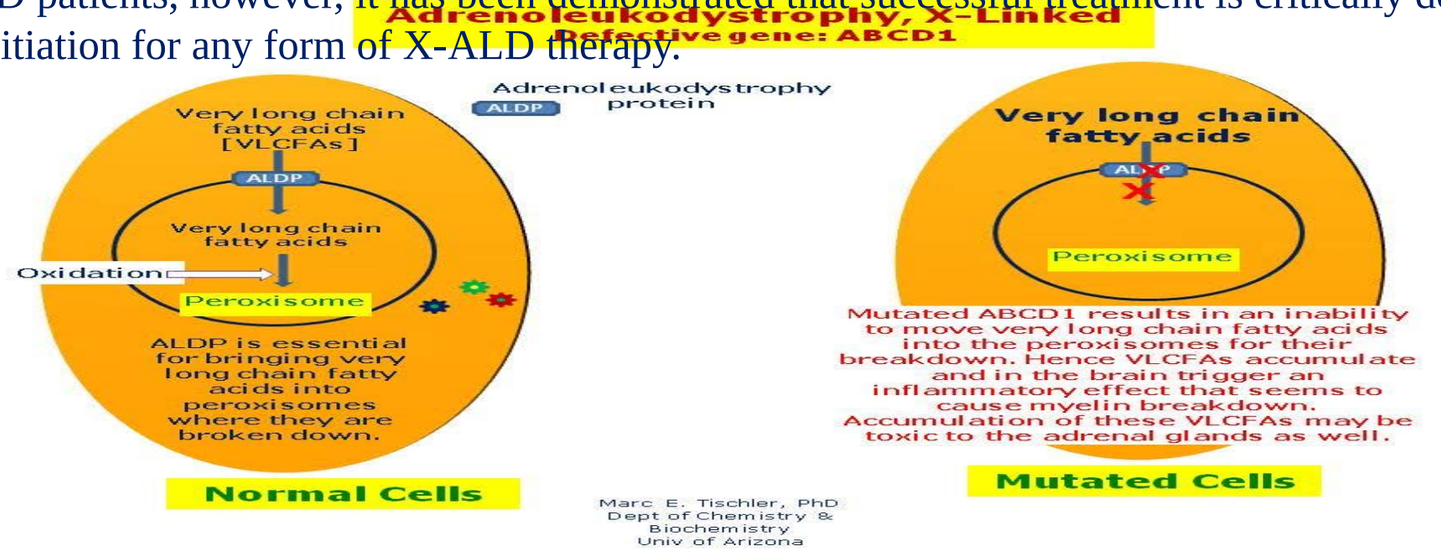
CT Newborn Screening



X-Linked Adrenoleukodystrophy (X-ALD)

X-ALD is the most common peroxisomal disorder with an estimated incidence of 1:17,000. This disorder is caused by mutations in the ALD peroxisomal transmembrane protein, ALDP, and the gene ABCD1. The severity of this mutation varies from childhood cerebral ALD (C-CALD), generally lethal with onset between ages 4 and 10, to adult-onset adrenomyeloneuropathy (AMN). Reduced activity of the peroxisomes for the breakdown of saturated very long-chain fatty acids (VLCFAs) causes increased levels of C26:0 VLCFA and accumulation of C26:0-lysophosphatidylcholine (C26:0-LPC), causing inflammatory demyelination of nerve cells within the brain and lesions that can be seen using an MRI. X-ALD often also causes the dysfunction of the adrenal gland, resulting in adrenal insufficiency or Addison's disease. The childhood form of the disease often leads to rapid degeneration, loss of cognitive ability, vegetative state and death. The milder adult-onset form, AMN**,** typically begins between ages 21 and 35. Symptoms include progressive stiffness, weakness or paralysis of the lower limbs and can also result in deterioration of brain function. About half the women who are X-ALD heterozygote will develop a milder form of AMN but will almost never develop symptoms seen in males with X-ALD. Limited therapy (BMT, Lorenzo's oil) is available for X-ALD patients, however, it has been demonstrated that successful treatment is critically dependent on pre-symptomatic initiation for any form of X-ALD therapy.

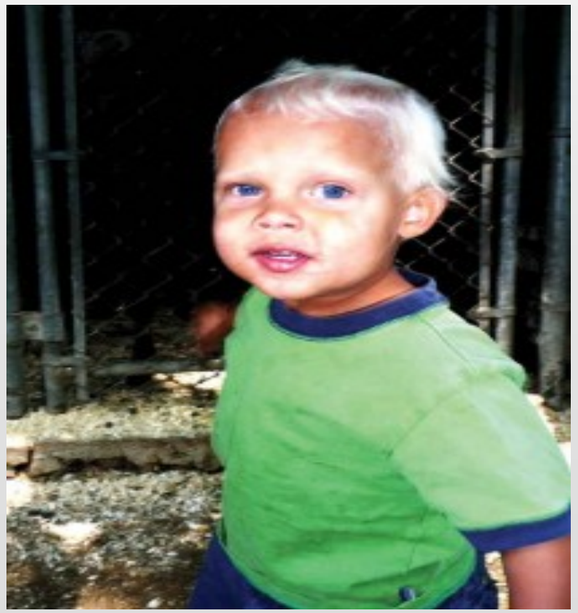




X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

ALD HISTORY AND ADVOCACY IN CONNECTICUT

June 26, 2008: 2-year old Joshua Florian died after a fever from undiagnosed Addison's disease. Later this was diagnosed as having a non-inherited type of X-ALD



Brian's Hope/The Kelley Family

At 6 Brian Kelley was diagnosed with X-ALD. Within six months of the diagnosis Brian, now 28, lost his mobility, speech, ability to eat and most of his vision and has been confined to a wheelchair. His parents Jean and Dr. Jack Kelley have been raising awareness for the importance of early detection of X-ALD through NBS and by speaking at various hearings and venues such as the Advisory Committee on Heritable Disorders in Newborns and Children meetings advocating for the addition of X-ALD to the RUSP

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

X-ALD HISTORY AND ADVOCACY IN CONNECTICUT

►01/2013: SB 465 , An Act Requiring Newborn Screening for X-ALD was proposed

►07/2013: Public Act 13-242 was approved with language added regarding the development and validation of reliable methodology or an FDA cleared kit

►Commissioner of Public Health elected to delay the start of X-ALD screening until after the addition of X-ALD to the RUSP

►08/2015: Advisory Committee on Heritable Disorders in Newborns and Children voted in favor of the addition of X-ALD to RUSP

► 09/2015: Validation of CDC negative-ion LC-MS/MS method for X-ALD screening began

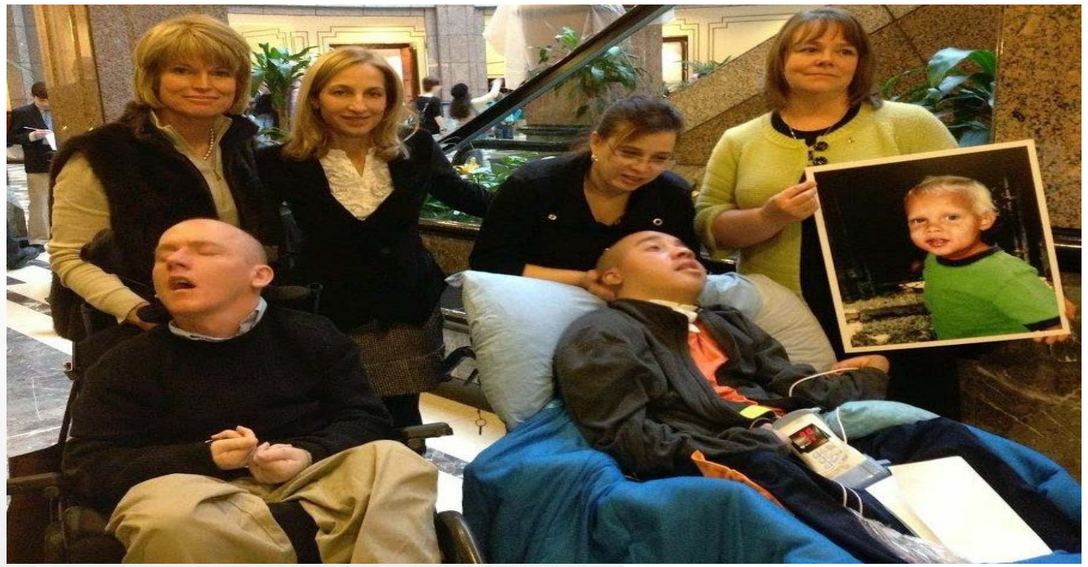
► Non-patient sample analyses completed prior to patient sample analysis in order to assess the instrument and analysts' precisions and accuracy via coefficient of variation (% CV), % Bias, % Recovery, linearity, carryover, drift and analytical range calculations by using quality controls obtained from the CDC

► Patient analysis portion of the validation included over 27,000 newborn samples

► 07/01/2016: X-ALD Screening went live in CT

► All infants born as of October 1, 2015 screened for X-ALD

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut



X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

Clinica Chimica Acta 413 (2012) 1217–1221

Contents lists available at SciVerse ScienceDirect

Clinica Chimica Acta

journal homepage: www.elsevier.com/locate/clinchim

Improved analysis of C26:0-lysophosphatidylcholine in dried-blood spots via negative ion mode HPLC–ESI–MS/MS for X-linked adrenoleukodystrophy newborn screening

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Newborn Screening and Molecular Biology Branch, Centers for Disease Control and Prevention, 4770 Buford Hwy. NE, Atlanta, GA 30341, USA

Newborn Screening and Molecular Biology Branch			
Title: **Quantitation of Lysophosphatidylcholines**			
Document Number: **NSMB-C-METHOD.001**	Version: **01**	Effective Date: **June 3, 2015**	**Page 1 of 7**

1. PURPOSE

To provide a written standard operating procedure (SOP) for the quantitation of hexacosanoyl lysophosphatidylcholine (C26:0-LPC) and lignoceroyl lysophosphatidylcholine (C24:0-LPC) using high-performance liquid chromatography (HPLC) coupled to electrospray ionization (ESI) and tandem mass spectrometric (MS/MS) analysis.

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

SAMPLE PREPARATION PROCEDURE

►Internal Standard (IS): 26:0-d4 Lyso PC 1-hexacosanoyl-d4-2-hydroxy-sn-glycero-3-phosphocholine, 5mg (Catalog# 860389P), Avanti Polar Lipids, Inc.

►Preparation of IS Stock Solution: Reconstitute 5mg IS material with 50mL Methanol—sonication of the solution is necessary to dissolve fully

►Dilute an aliquot of stock solution in 200mL Methanol to prepare Extraction Solution/IS Spiking Solution

►Punch 3.2mm blood spots into a 96-well plate

►Add 100µL IS Spiking Solution to each well containing a blood spot

►Shake for 30 minutes at 31ºC and 650 rpm shaking speed

►Transfer extracts to a NUNC heat resistant polypropylene microtiter plate and cover plate with foil

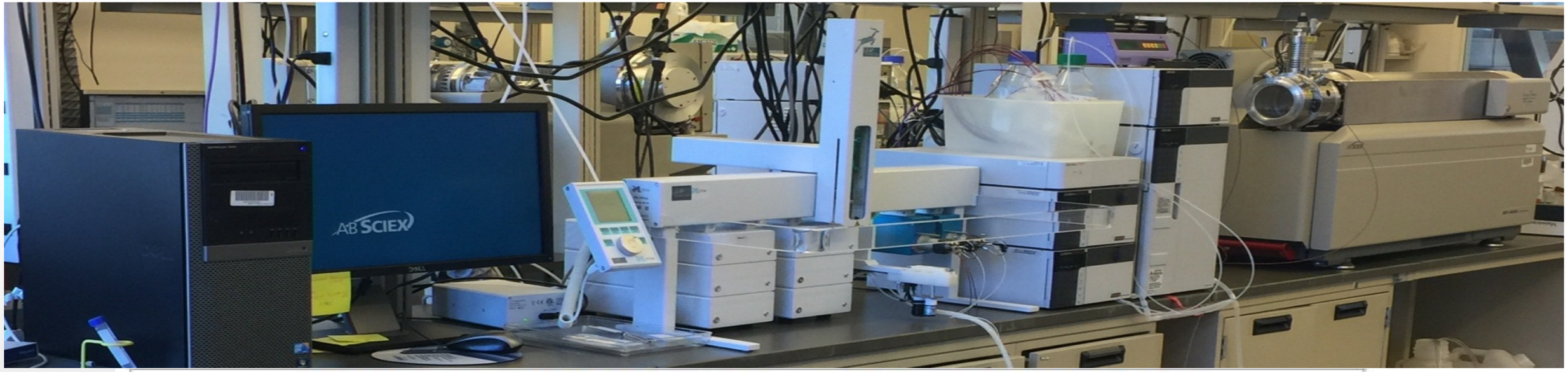
ANALYSIS PROCEDURE

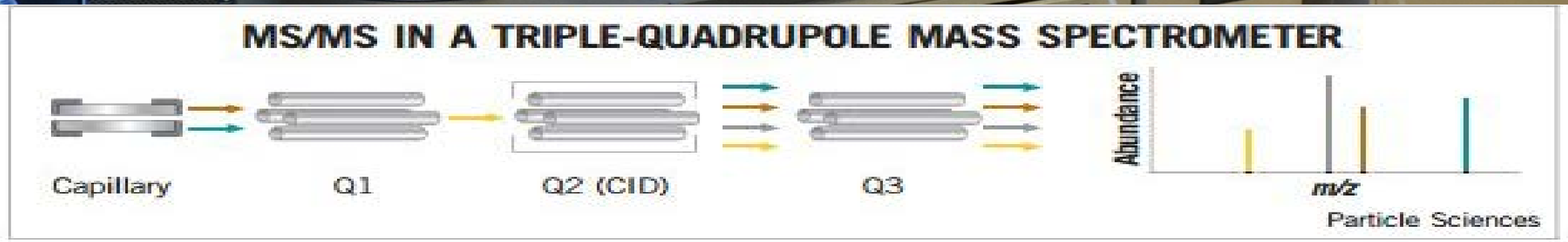
►Analyze extracts using a Triple Quadrupole LC-MS/MS instrument with Turbo Spray Ion Source in negative ionization mode

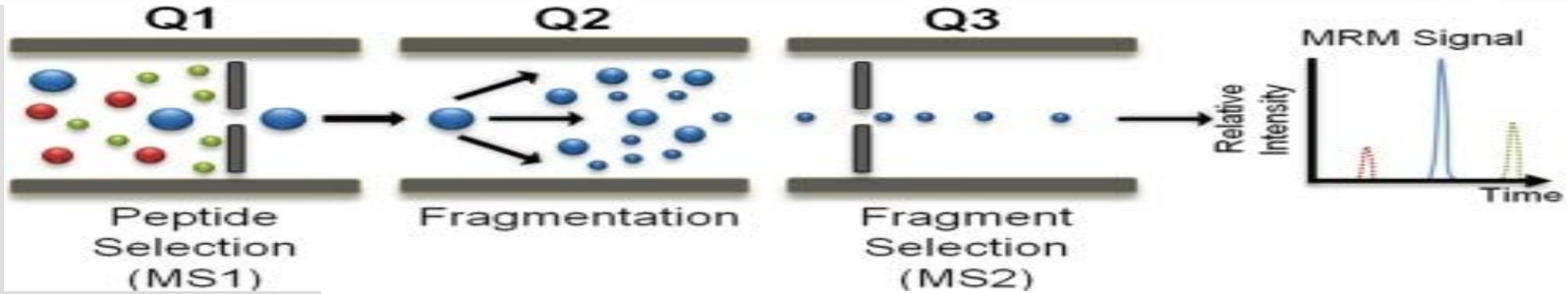
►LC isocratic flow of 50:50 methanol/ acetonitrile with 5mM Ammonium Acetate at 0.45mL/min, Waters XTerra MS C8 Column, 125Å, 2.5 µm, 2.1 mm X 50 mm

►20µL Sample Injection Volume, Total run time: 1.11 min

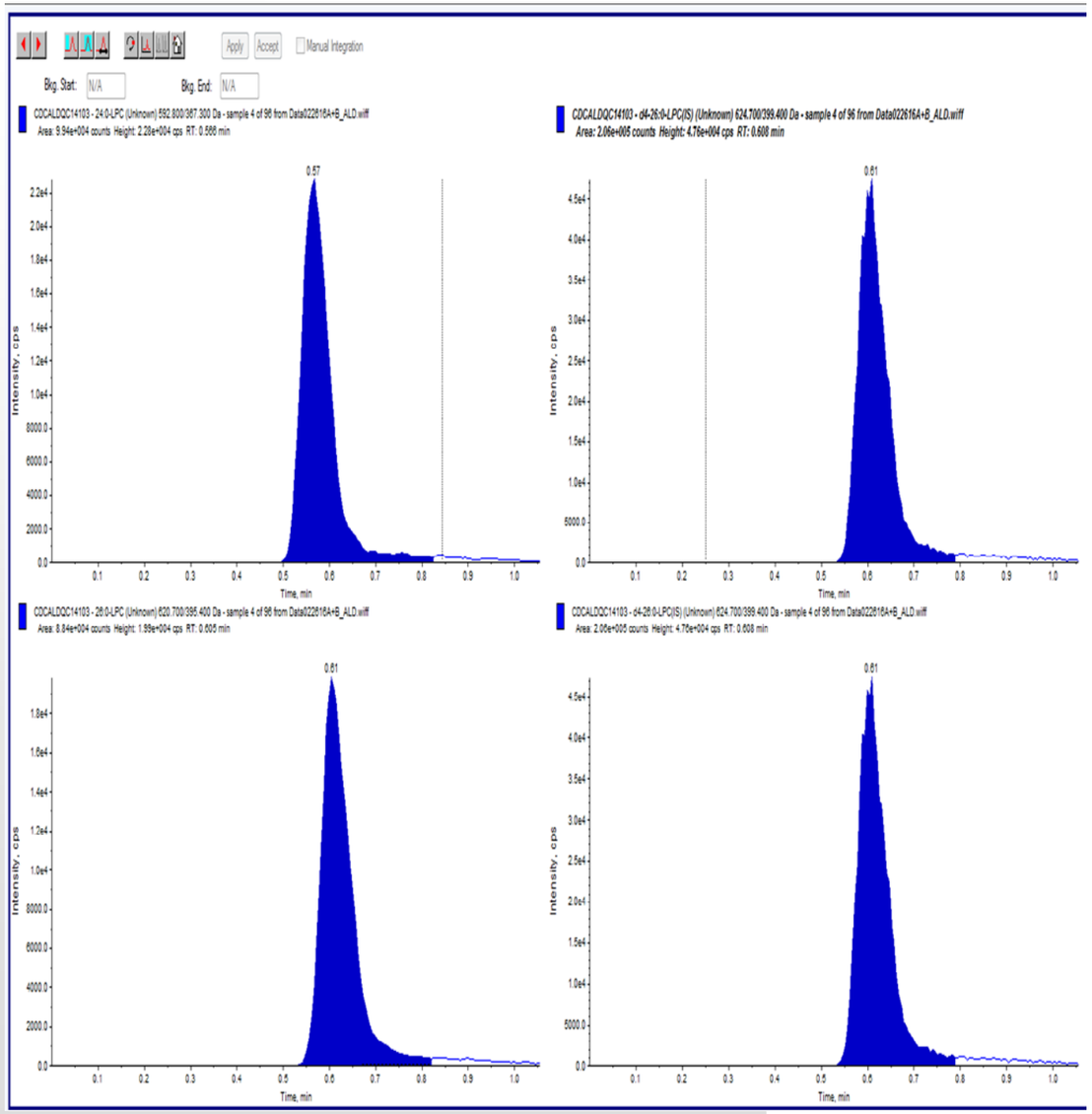
X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

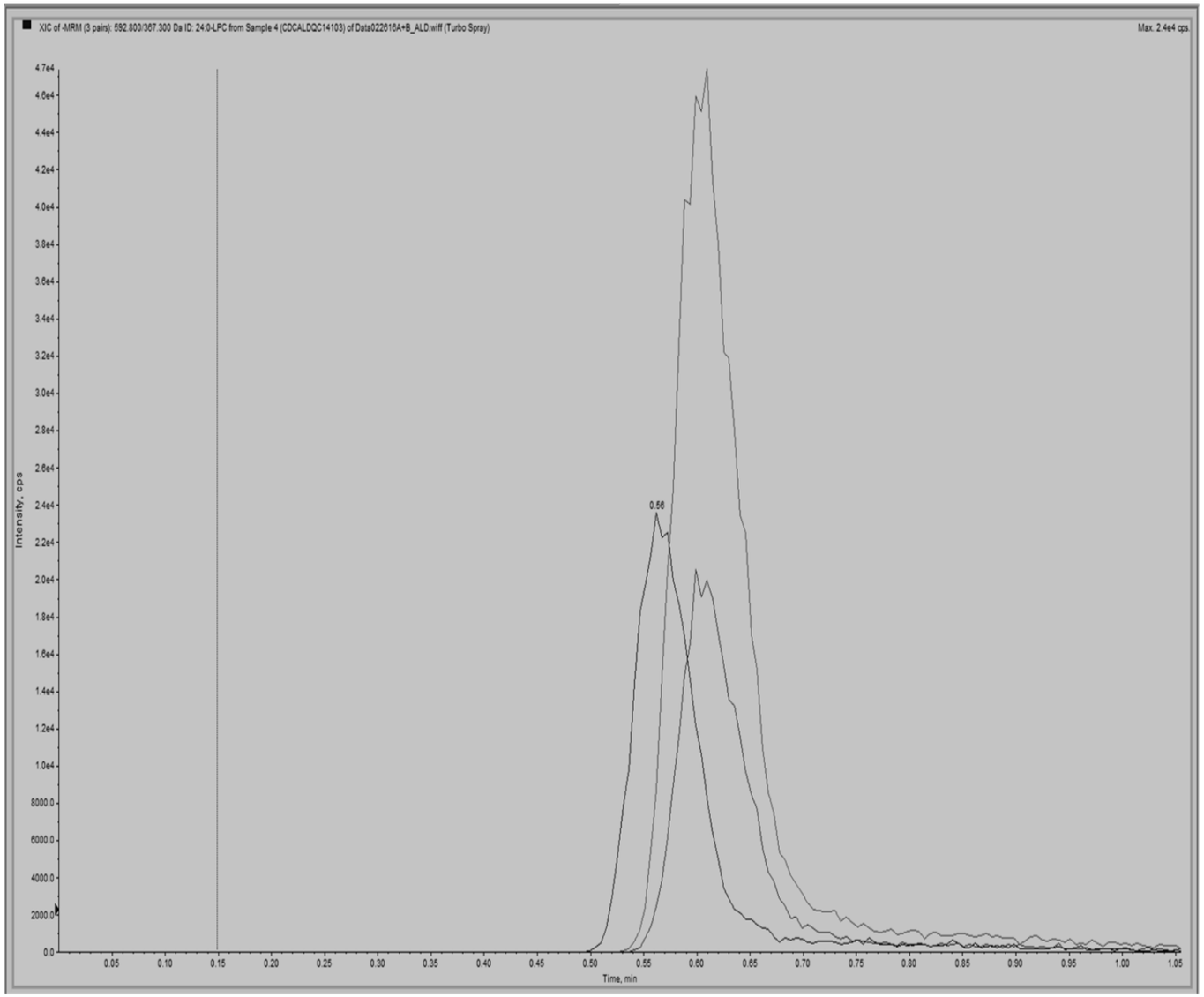






X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut





X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

Connecticut Precision Results:

C24:0-LPC Overall Instrument Precision				
QC ID	**Batch Info**	**Mean (µmol/L)**	**Standard Deviation**	**% CV**
CDCQC14101	Both Instruments Overall	0.0564	0.0106	18.84%
CDCQC14102	Both Instruments Overall	0.8226	0.170	20.63%
CDCQC14103	Both Instruments Overall	3.6476	0.599	16.42%

C26:0-LPC Overall Instrument Precision				
QC ID	**Batch Info**	**Mean (µmol/L)**	**Standard Deviation**	**% CV**
CDCQC14101	Both Instruments Overall	0.0252	0.0046	18.16%
CDCQC14102	Both Instruments Overall	0.8013	0.122	15.20%
CDCQC14103	Both Instruments Overall	3.8146	0.573	15.03%

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

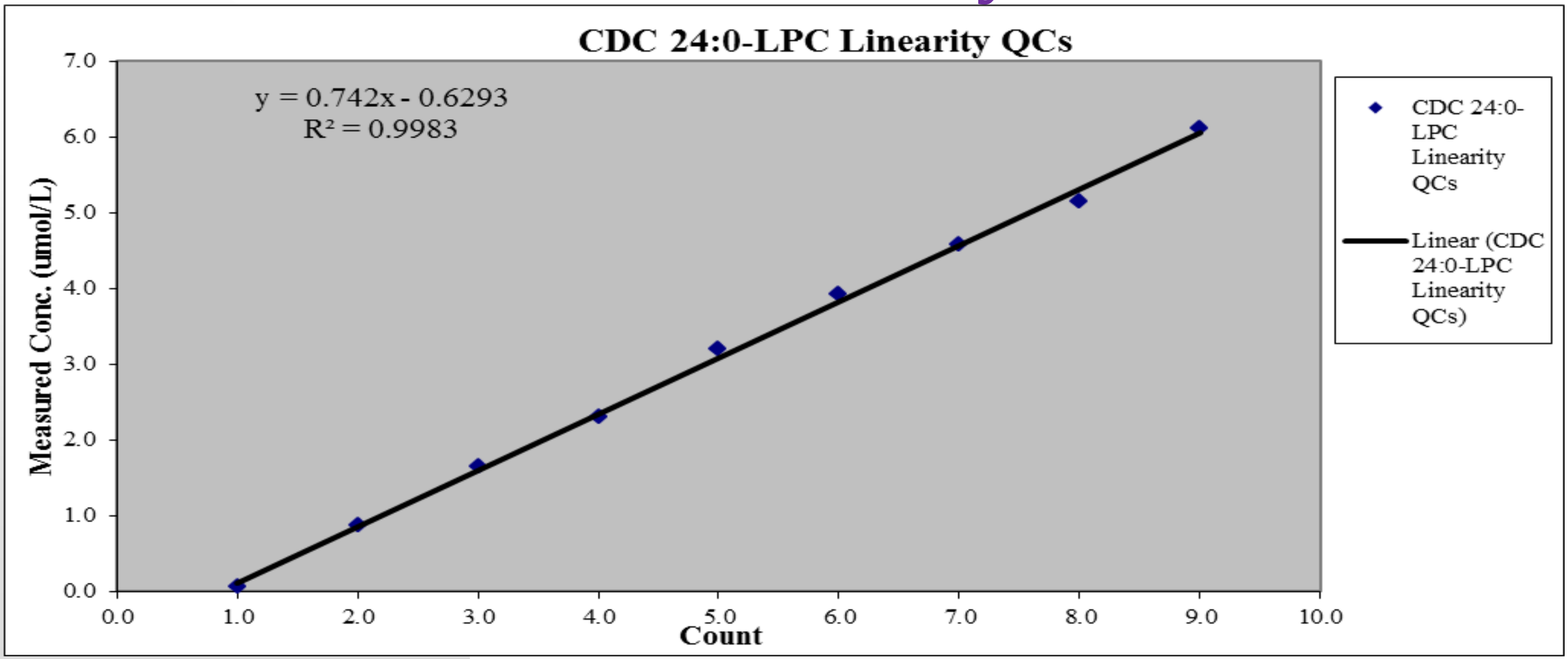
Connecticut Accuracy Results:

C24:0-LPC Overall Instrument Accuracy					
QC ID	**Batch Info**	**Nominal Concentration (µmol/L)**	**Mean (µmol/L)**	**% Bias**	**% Recovery**
CDCQC14101	Both Instruments Overall	0.000	0.056	NA	NA
CDCQC14102	Both Instruments Overall	1.00	0.823	17.74%	76.62%
CDCQC14103	Both Instruments Overall	5.00	3.648	27.05%	71.82%

C26:0-LPC Overall Instrument Accuracy					
QC ID	**Batch Info**	**Nominal Concentration (µmol/L)**	**Mean (µmol/L)**	**% Bias**	**% Recovery**
CDCQC14101	Both Instruments Overall	0.000	0.025	NA	NA
CDCQC14102	Both Instruments Overall	1.00	0.801	19.87%	77.61%
CDCQC14103	Both Instruments Overall	5.00	3.815	23.71%	75.79%

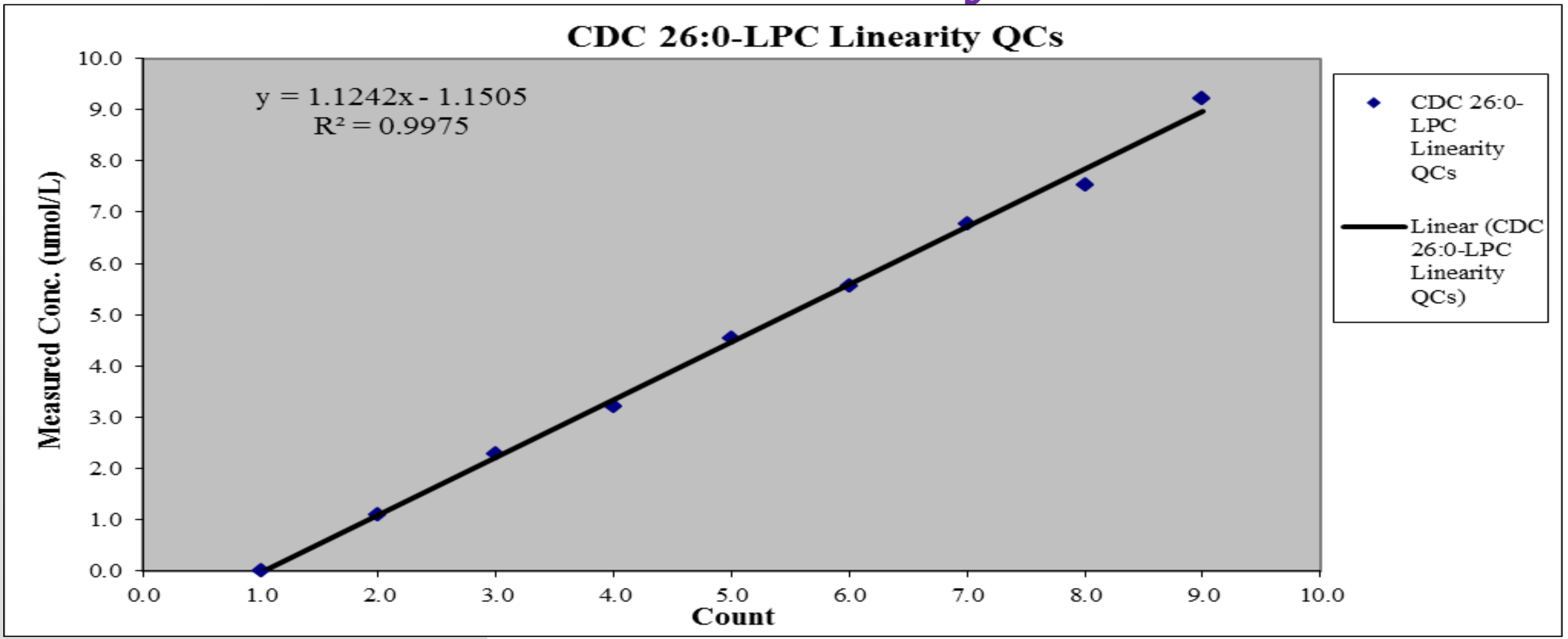
X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

Connecticut Linearity Results:



X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

Connecticut Linearity Results:



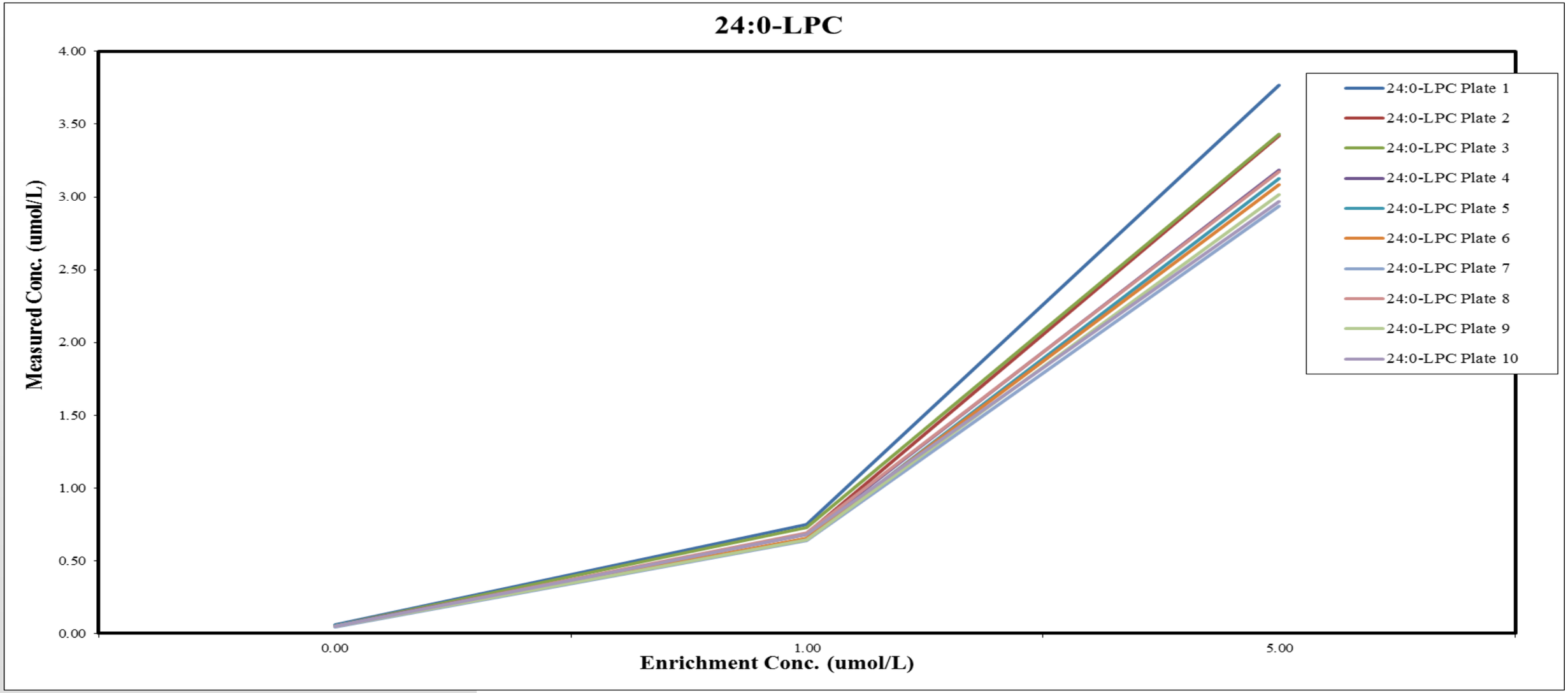
X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

Connecticut Carryover Results:

	C24:0-LPC			C26:0-LPC		
Parameters Evaluated	**MS 1 (µmol/L)**	**MS 2 (µmol/L)**	**Overall MS (µmol/L)**	**MS 1 (µmol/L)**	**MS 2 (µmol/L)**	**Overall MS (µmol/L)**
First Set CDC14101 Mean	0.0597	0.0577	0.0587	0.0267	0.0245	0.0256
Second Set CDC14101 Mean	0.0611	0.0608	0.0609	0.0296	0.0282	0.0289
% Difference (1st set vs 2nd set)	-2.35%	-5.28%	3.79%	10.78%	15.11%	12.85%
2-tailed TTest	0.536	0.288	0.219	0.035	0.002	0.001
if p > 0.05 differences are not significant	OK	OK	OK	Flag	Flag	Flag
Patient Cutoff	0.15	0.15	0.15	0.16	0.16	0.16
Potential Carryover (Patient Cutoff * % Mean Difference)	NA	NA	NA	0.0173	0.0242	0.0206
Instrument Potential False Positive Lower Limit Threshold from Carryover	NA	NA	NA	0.1427	0.1358	0.1394

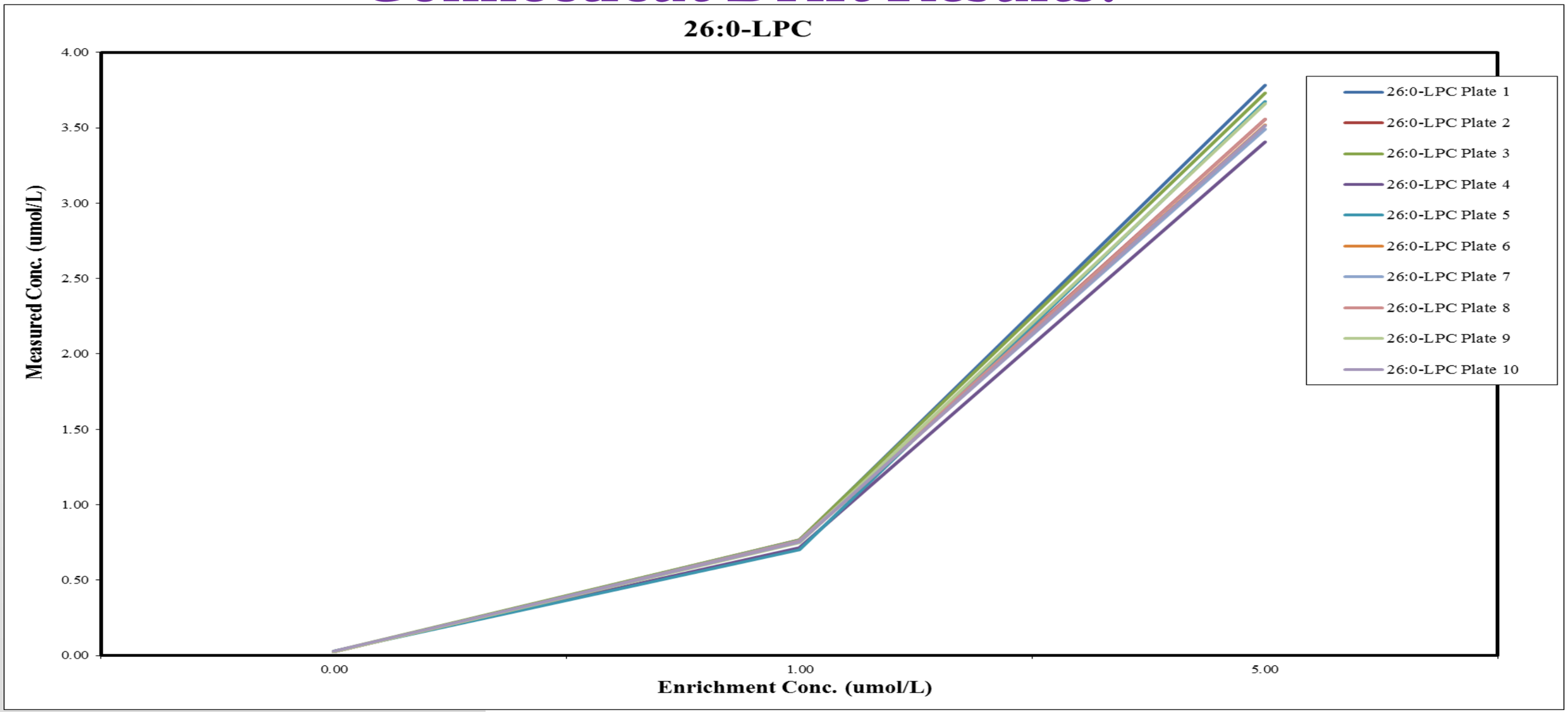
X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

Connecticut Drift Results:



X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

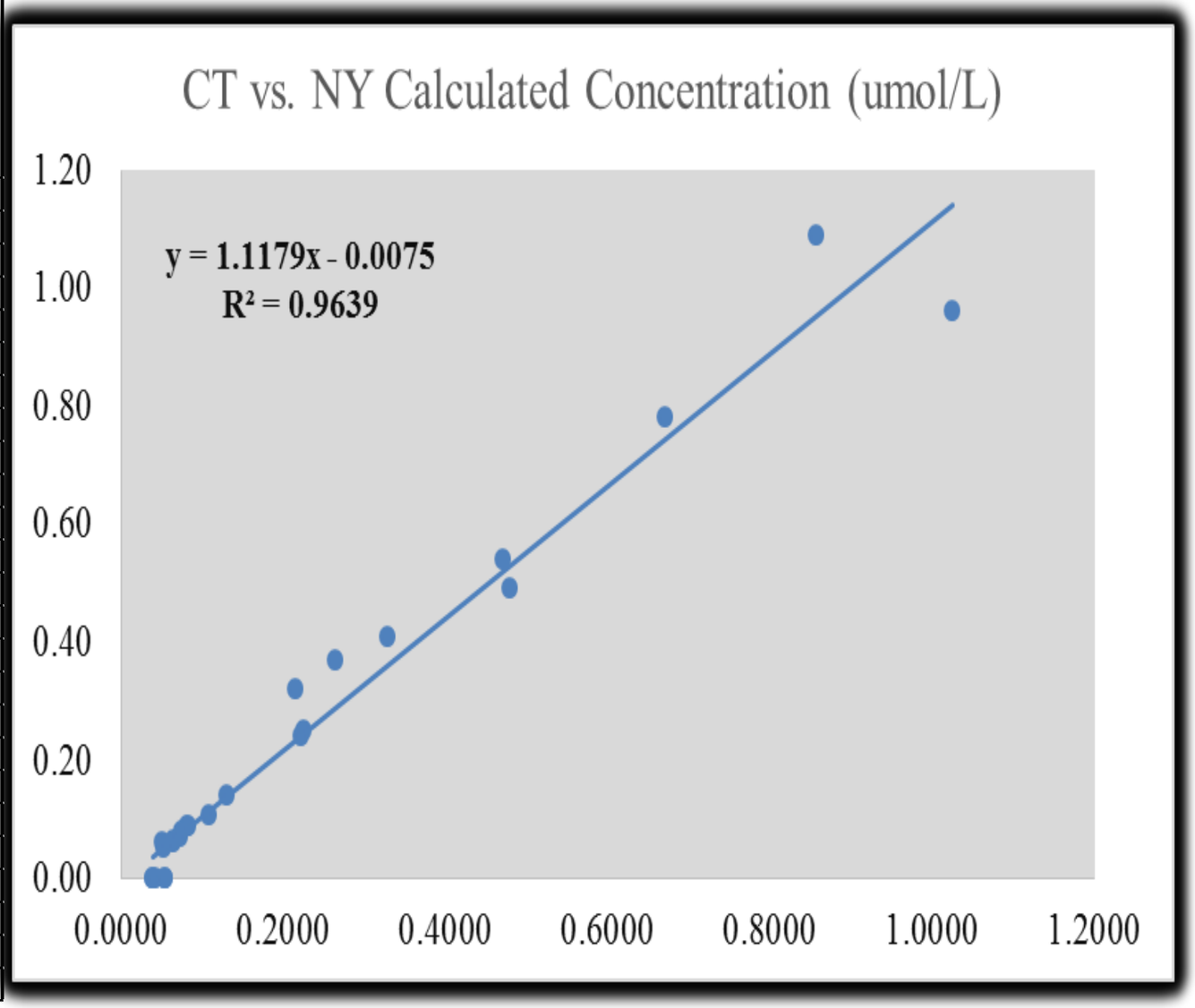
Connecticut Drift Results:



X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

Connecticut Blinded NY Sample Results:

Patient ID	CT Calculated Concentration (µmol/L)	Tier 2: NY Calculated Concentration (µmol/L)	Absolute % Difference Calculations	Analyte	Sample Diagnosis UNBLINDED
NY001	0.2647	0.3700	28.47%	26:0-LPC	Borderline
NY002	1.0261	0.9600	6.88%	26:0-LPC	ALD Boy
NY003	0.2219	0.2400	7.56%	26:0-LPC	Borderline
NY004	0.4803	0.4900	1.99%	26:0-LPC	ALD Boy
NY005	0.1304	0.1400	6.87%	26:0-LPC	Normal
NY006	0.0514	0.0600	14.28%	26:0-LPC	Normal
NY007	0.0636	0.0600	6.06%	26:0-LPC	Normal
NY008	0.4712	0.5400	12.73%	26:0-LPC	ALD Boy
NY009	0.0730	0.0700	4.22%	26:0-LPC	Normal
NY010	0.0836	0.0900	7.06%	26:0-LPC	Normal
NY011	0.6708	0.7800	14.00%	26:0-LPC	Zellweger
NY012	0.0549	N/A	NA	26:0-LPC	Normal
NY013	0.0388	N/A	NA	26:0-LPC	Normal
NY014	0.3280	0.4100	20.00%	26:0-LPC	ALD Boy (lowest)
NY015	0.0390	N/A	NA	26:0-LPC	Normal
NY016	0.0812	0.0900	9.83%	26:0-LPC	Normal
NY017	0.0427	N/A	NA	26:0-LPC	Normal
NY018	0.0548	N/A	NA	26:0-LPC	Normal
NY019	0.2253	0.2500	9.88%	26:0-LPC	Borderline
NY020	0.1077	0.1077	0.00%	26:0-LPC	Normal
NY021	0.8571	1.0900	21.37%	26:0-LPC	ALD Boy
NY022	0.0642	0.0642	0.00%	26:0-LPC	Normal
NY023	0.0521	0.0521	0.00%	26:0-LPC	Normal
NY024	0.2146	0.3200	32.94%	26:0-LPC	Borderline
NY025	0.0737	0.0800	7.87%	26:0-LPC	Normal



X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

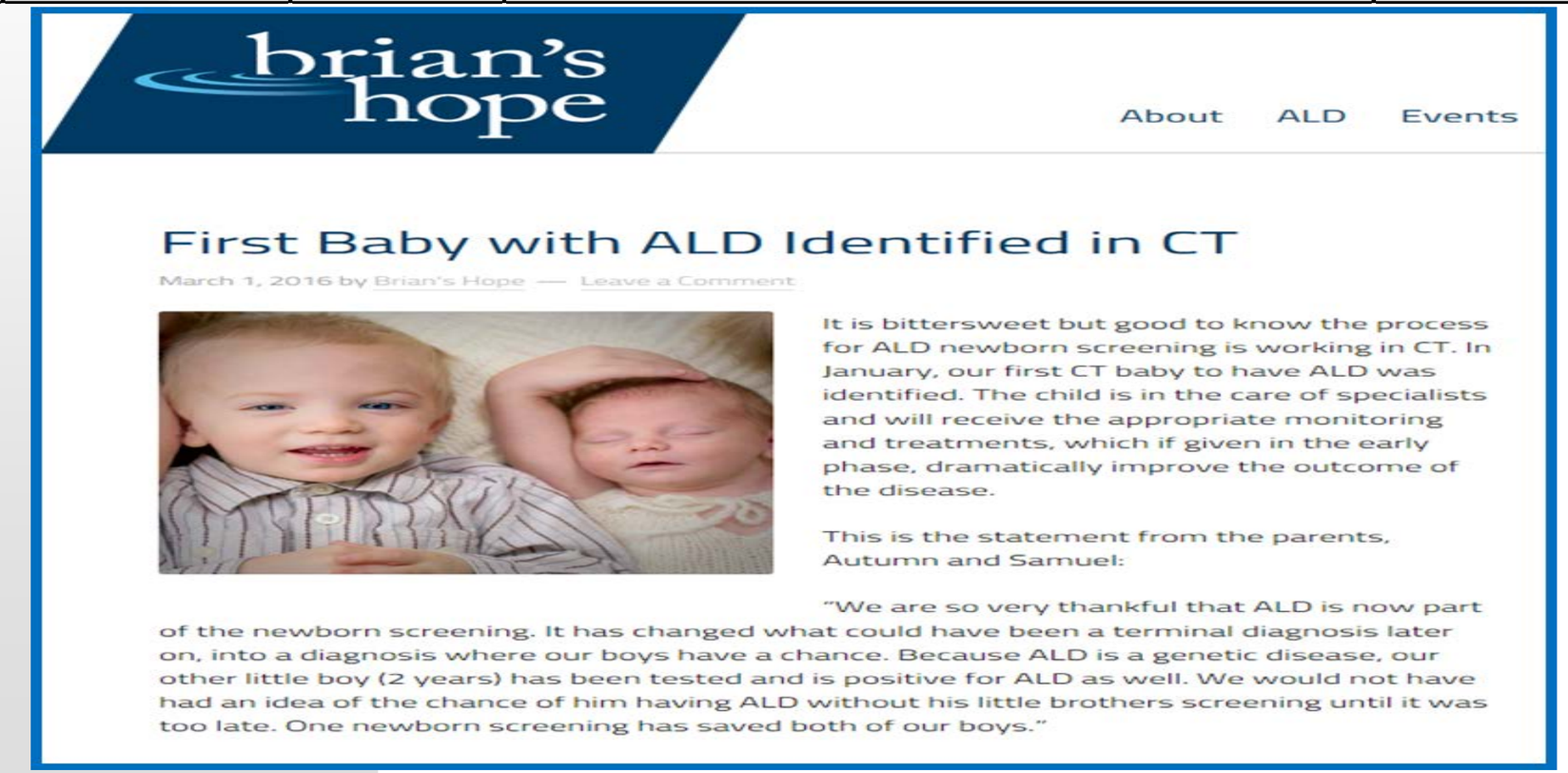
Connecticut Validation Sample Results:

0.24	NY 26:0-LPC cutoff (lower)	**Request for another sample**	**Proposed Connecticut Reporting Algorithm**
32.94%	Largest % Difference NY vs CT (CT values lower than NY)		
0.0791	(% Difference CT vs NY) * NY cutoff		
0.16	**CT Calculated lower cutoff (NY cutoff -((% Difference CT vs NY) * NY cutoff))**		
0.39	NY 26:0-LPC cutoff (upper)	**Refer child for followup testing**	
32.94%	Largest % Difference NY vs CT (CT values lower than NY)		
0.128	(% Difference CT vs NY) * NY cutoff		
0.26	**CT Calculated upper cutoff (NY cutoff -((% Difference CT vs NY) * NY cutoff))**		

	24:0-LPC (µmol/L)	26:0-LPC (µmol/L)
Mean	0.0654	0.0606
Median	0.0633	0.0593
25th Percentile	0.0528	0.0503
75th Percentile	0.0757	0.0690
99th Percentile	0.1185	0.1011
Borderline Cutoff (99.9th percentile)	NA	0.157
Presumptive Positive Cutoff	0.157 (99.9th)	0.257 (99.98th)
Range	0.0118 to 0.3917	0.0143 to 0.9098
Number Analyzed during the validation	27495	27495

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

Initial Laboratory ID	Accession #	DOB	NBS Initial Sample Result	NBS Repeat Sample Result	Final Result
562036001	74733553	1/1/2016	Borderline ABN, repeat sample requested	ABNORMAL	X-ALD
565567001	74474057	1/14/2016	Borderline ABN, repeat sample requested	NORMAL	NORMAL
565276001	74726136	1/16/2016	Borderline ABN, repeat sample requested	NORMAL	NORMAL
565562001	74294451	1/18/2016	Borderline ABN, repeat sample requested	NORMAL	NORMAL
587503001	74419936	4/12/2016	ABNORMAL REFERRAL	ABNORMAL	X-ALD
595530001	75410142	5/11/2016	ABNORMAL REFERRAL	ABNORMAL	X-ALD



brian's hope

About ALD Events

First Baby with ALD Identified in CT

March 1, 2016 by Brian's Hope — Leave a Comment

It is bittersweet but good to know the process for ALD newborn screening is working in CT. In January, our first CT baby to have ALD was identified. The child is in the care of specialists and will receive the appropriate monitoring and treatments, which if given in the early phase, dramatically improve the outcome of the disease.

This is the statement from the parents, Autumn and Samuel:

"We are so very thankful that ALD is now part of the newborn screening. It has changed what could have been a terminal diagnosis later on, into a diagnosis where our boys have a chance. Because ALD is a genetic disease, our other little boy (2 years) has been tested and is positive for ALD as well. We would not have had an idea of the chance of him having ALD without his little brothers screening until it was too late. One newborn screening has saved both of our boys."

http://brianshope.org/brians-hope-news/first-baby-with-ald-identified-in-ct/

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

SHORT TERM FOLLOW-UP AND TRACKING

- Communicate with Hospital and/or PCP regarding need for a repeat NBS specimen or referral to diagnostic/treatment center
- Referral to Dr. Michelle Manzon, Yale School of Medicine, Department of Genetics, when appropriate
- Obtain names, DOBs and gender of siblings and communicating this information to the NBS Lab and Yale Genetics
- Follow up through diagnosis or exclusion of X-ALD
- Educating stakeholders about X-ALD

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

DIAGNOSTIC/TREATMENT CENTER FOLLOW UP

Diagnostics:

- **VLCFA—Kennedy Krieger Lab**
- **ABCD1 Sequence Analysis—Baylor Lab**

Confirmed X-ALD:

- **Testing of siblings, other family members**
- **Females: Seen once in clinic for counseling then followed by PCP**
- **Males: Seen in clinic for consultation by Endocrinology, Neurology and Hematology (if considering stem-cell transplant). Ongoing follow-up with specialty providers.**

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

CT X-ALD FAQ:

CT definition of an abnormal screen? All results ≥ 0.157µmol/L for either C24:0-LPC or C26:0-LPC.

How is that different during the pilot vs. population screening phases? Previous reporting algorithms were to report C26:0-LPC as a primary analyte with C24:0-LPC not reported alone. During Minnesota's X-ALD validation they sent potential abnormal and true abnormal samples to CT for a second look. One known confirmed patient only had C24:0-LPC elevations.

How do you establish cut-offs? How is this different during the pilot vs. when you implement? Cutoffs were established using population percentile calculations combined with comparison of results obtained through confirmed patient sample analysis with state that supplied samples to determine if there was an overlap despite methodology differences.

What are your repeat rates for screening positive/borderline results? On average 1-3 samples/week repeat for borderline samples.

What changes did you have to make to the laboratory to prepare for screening? No changes were made to the laboratory.

What changes did you have to make to your workflow? Very little change was made to workflow since method is quick and so many analysts are cross-trained for LC-MS/MS analysis/usage.

What changes did you make to your personnel/staffing? No changes, existing staff were trained for method and instrumentation.

What came up that you did not think about? Instrument maintenance required more frequently due to "stickiness" of compounds. Preventative steps added to instrument routine/daily maintenance.

What solution did you come up with? Rail bake method analyzed once a week overnight, divert valve included in method.

Who did you reach out to for support/guidance? Sciex service engineers offered assistance and provided rail bake method as well as refresher training for cleaning Q0 of MS/MS instruments.

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

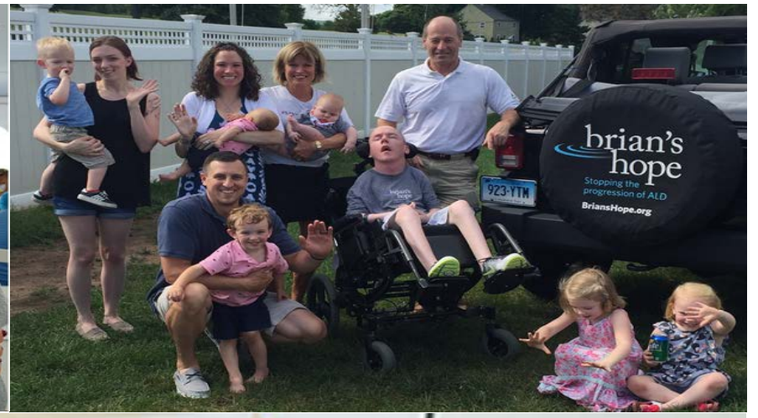
Connecticut Updated Sample Results:

Number of infants analyzed as of 08/01/17 (10/1/2015-08/01/2017)	67694
Total Screen Positive	24
Samples reported with 2nd request	12
Samples normal on second sample analysis	10
False Positive 2016	1
False Positive 2017	2
Confirmed ALD diagnosis newborn infant results	10 (5 male, 5 female)
Siblings Identified (and confirmed at Treatment Center) with ALD	2 (1 male, 1 female)
Other	1 Zellweger 2017
Number Reported Abnormal PPV (Positive Predictive Value (PPV) = Number of infants with an out-of-range result from a first or subsequent dried blood spot specimen requiring clinical diagnostic workup by an appropriate medical professional and with a confirmed diagnosis of the disorder by an appropriate medical professional, divided by the number of infants with an out-of-range result from the dried blood spot screen requiring a repeat specimen or a clinical diagnostic workup by an appropriate medical professional, reported by disorder category.; Note* Zellweger case included in confirmed case total)	45.83%
Number Referred PPV (total confirmed with disease/total referred; Note* Zellweger case included in confirmed case total)	78.57%
PPV Abnormal ALD ONLY	41.67%
PPV Referred ALD ONLY	71.43%
Incidence Overall	~1:6,769
Incidence Male	~1:13,539

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut

#	ID #	Gender	Interpretation/Action	Outcome	Notes	Birth Year	Spec Collected (age/days)	Spec Received (age/days)	24:0-LPC Abn	26:0-LPC Abn	BW, EGA
1	74733553	M	1st NBS Bdl/Repeat 2nd NBS Bdl/Refer	ALD Confirmed	screened + during validation; older sibling also confirmed + followed in VA	2016	1 15	4 19	no yes	yes yes	3515g, 38w
2	74474057	F	Bdl/Repeat	Repeat NBS WNL	screened + during validation	2016	1	5	no	yes	2685g, 39w
3	74726136	F	Bdl/Repeat	Repeat NBS WNL	screened + during validation	2016	1	2	no	yes	3389g, 38w
4	74294451	F	Bdl/Repeat	Repeat NBS WNL	screened + during validation	2016	1	2	no	yes	3625g, 39w
5	74419936	M	PP/Refer	ALD Confirmed	screened + during validation	2016	1	1	yes	yes	3590g, 41
6	75410142	F	PP/Refer	ALD Confirmed	screened + during validation	2016	2	2	yes	yes	3520g, 39
7	74734207	F	PP/Refer	ALD Confirmed	older sibling also confirmed +	2016	1	2	yes	yes	2835g, 39w
8	75037712	M	PP/Refer	ALD Confirmed		2016	1	5	yes	yes	3110g, 40w
9	74077683	F	PP/Refer	ALD Confirmed		2016	2	3	yes	yes	3114g, 39w
10	74244491	F	PP/Refer	Zellweger Syndrome	NICU baby	2016	1	5	yes	yes	2665g, 39w
11	74456811	F	PP/Refer	ALD ruled-out		2016	2	4	no	yes	3290g,40w
12	74285277	M	Bdl/Repeat	Repeat NBS WNL		2017	1	3	yes	yes	2305g, 34w
13	75038781	F	Bdl/Repeat	Repeat NBS WNL	NICU baby	2017	1	3	yes	no	1065g,31w
14	76263216	F	PP/Refer	ALD Confirmed		2017	2	3	yes	yes	2745g,37w
15	75420258	M	PP/Refer	ALD Confirmed	followed in Boston	2017	2	6	yes	yes	3875g, 39w
16	74235412	F	PP/Refer	ALD Confirmed		2017	1	3	yes	yes	3960g, 40w
17	74285468	F	PP/Refer	ALD ruled-out		2017	1	2	yes	yes	2670g, 41w
18	74772877	F	Bdl/Repeat	Repeat NBS WNL		2017	1	2	no	yes	2335g, 36w
19	74457331	M	1st NBS Bdl/Repeat 2nd NBS Bdl/Refer	ALD ruled-out	NICU baby	2017	<24h 6	4 8	yes yes	no no	1225g, 31w
20	74457449	F	Bdl/Repeat	Repeat NBS WNL		2017	1	4	yes	no	2935g, 39w
21	74728110	M	PP/Refer	ALD Confirmed		2017	1	6	yes	yes	3920g, 40w
22	74285815	F	Bdl/Repeat	Repeat NBS WNL		2017	1	3	yes	no	1925g, 34w
23	74773010	M	Bdl/Repeat	Repeat NBS WNL	NICU baby	2017	1	4	yes	no	2990g, 39w
24	76030548	M	Bdl/Repeat	Repeat NBS WNL	NICU baby	2017	1	4	yes	no	2185g, 34w

X-Linked Adrenoleukodystrophy (X-ALD) In Connecticut



CT NBS Parent Information

The State of Connecticut Newborn Screening Program

Make Sure Your Baby is Healthy

Checklist:

- ☐ Ask your doctor, nurse or midwife about Newborn Screening (NBS)
- ☐ Pick a doctor for your baby before your baby is born
- ☐ Make an appointment with your baby's doctor before you leave the hospital
- ☐ Ask if your baby had the NBS test done before you leave the hospital
- ☐ Ask your baby's doctor for the results of your baby's NBS test
- ☐ Give a phone number where you can be reached after you leave the hospital
  - If you do not have a phone, give a friend's or family member's phone number
- ☐ Call the doctor if your baby:
  - has trouble eating
  - vomits often
  - has skin problems
  - is very sleepy all the time
  - looks sick

Newborn Screening (NBS) is important!

Babies with some health problems may not look sick when they are born but they can have trouble eating, gaining weight or have slow brain growth. They can also become very sick and sometimes die. Newborn Screening (NBS) helps find babies with certain health problems, so treatment can start early. Early treatment can help prevent serious illness and death.

Answers To Your Questions about Newborn Screening

Why does my baby need NBS?

- Without NBS, you cannot tell if your baby has certain health problems
- Connecticut NBS tests for over 60 health problems
- If one of these health problems is not treated, your baby may:
  - become very sick
  - grow poorly
  - have a physical disability
  - have brain damage
  - die
- With early treatment many problems can be prevented

Who should get the test?

- Every newborn baby should be tested

When is the test done?

- One to three days after birth

How is the test done?

- The doctor, nurse or midwife will take a few drops of blood from your baby's heel
- The blood is tested at the State Public Health Laboratory in Rocky Hill

Can I say "no" to this test?

- You can say "no" to the test for religious reasons
- You will be asked to sign a form that says you do not want your baby to be tested

How do I get the test results?

- Ask your baby's doctor for the results

DPH

More Answers to Your Questions

What does an abnormal result mean?

- It does not always mean that your baby is sick
- There are many things that can cause an abnormal result
- An abnormal result can happen:
  - if you took certain medicines while pregnant
  - if your baby was born early
  - if your baby's blood was collected too soon
  - if your baby had certain treatments while in the hospital
  - for many other reasons
- If your baby has an abnormal NBS test your doctor may:
  - examine your baby
  - ask about illness in your family
  - repeat the NBS test
  - order a different test
  - talk to a genetics doctor

If my baby does have one of these medical problems, what will happen?

- Your doctor may:
  - give your baby a special diet
  - give your baby medicine
  - start other treatment
  - have your baby see a special doctor

More Questions?

- Talk to your baby's doctor, nurse or midwife
- Call the Connecticut NBS Program at: **(860) 920-6628**
- Go to:
  - http://savebabies.org/
  - http://www.babysfirsttest.org/
  - http://www.marchofdimes.org/baby/newborn-screening-tests-for-your-baby.aspx
  - http://www.ct.gov/dph/cwp/view.asp?a=3113&q=387742

DPH

What does Connecticut NBS test for?

Adrenoleukodystrophy (ALD): The body builds up fatty acids. This can cause brain damage. Babies with ALD will be monitored by a doctor for many years and be treated if needed.

Amino Acid (AA) Disorders: The body cannot use proteins in some foods like formula, breast milk and meats. This can cause slow physical growth and brain damage. A special diet and medicine can help prevent these problems. The CT NBS program tests for many types of AA problems.

Biotinidase (BIO) Deficiency: The body cannot make enough of the vitamin biotin. This can cause skin rashes, weak muscles, hair loss, trouble seeing and hearing, and brain damage. A vitamin can help prevent these problems.

Congenital Adrenal Hyperplasia (CAH): The body cannot make enough of certain hormones. This can cause severe illness or death. Medicine can help prevent these problems.

Congenital Hypothyroidism (CH): The body cannot make enough thyroid hormone. This can cause growth problems and brain damage. Medicine can help prevent these problems.

Fatty Acid Oxidation (FAO) Disorders: The body has trouble using fat for energy. This can cause sleepiness, weak muscles, vomiting, low blood sugar, liver problems and death. A special diet and medicine can help prevent these problems. The CT NBS program tests for many kinds of FAO problems.

Galactosemia (GALT): The body cannot use a sugar that is in milk, infant formula, breast milk and other foods. This can cause eye and liver problems, brain damage and death. A special diet can help prevent these problems.

Hemoglobin (Hb) Disease: The body has a problem with red blood cells. This can cause anemia, infection, pain, poor growth and death. Medicine and special medical care can help prevent these problems. The CT NBS program tests for many types of Hb problems. Sickle cell is one type of Hb disease.

Hemoglobin (Hb) Traits: This test tells if your baby is a carrier of a red blood cell disease. This does not mean that your baby is sick. Your doctor will talk to you about what this means and may want another blood test.

Organic Acid (OA) Disorders: The body cannot use certain proteins and fats in foods. This can cause vomiting, poor feeding, low blood sugar, sleepiness, seizures and death. A special diet and medicine can help prevent these problems. The CT NBS program tests for many types of OA problems.

Severe Combined Immunodeficiency Disorder (SCID): The body cannot fight infection. This can cause serious illness and death. Bone marrow transplant is a treatment for SCID.

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Thank You!