ARUP LABORATORIES

An enterprise of the University of Utah and its Department of Pathology

UTAH DEPARTMENT OF HEALTH

Newborn screening protocol for “sick” or “pre-term” newborns

Effective April 12, 2010

6 April 2010

Newborn Screening in Utah (2006)

- PKU
- Congenital Hypothyroidism
- Galactosemia
- Hemoglobinopathies
- Newborn Hearing Screening

- MCAD Deficiency
- MSUD
- Homocystinuria
- Biotinidase deficiency
- Congenital adrenal hyperplasia
- Others detectable by MS/MS
- Cystic Fibrosis (2009)

MS/MS screening in Utah: 2006-2009

- Total screens: 220,269
  - ***Total metabolic disorders: 114*** ***1:1,932***
    - 32 PKU/Hyperphe/Biopt 1: 6,883
    - 30 MCAD deficiency 1: 7,342
    - 9 3-Methylcrotonylglycinuria 1:11,013
    - 8 VLCAD deficiency 1:27,534
    - 3 Glutaric acidemia type I 1:73,423
    - ***12 Maternal disorders***
      - 6 Primary carnitine deficiency (CUD)
      - 4 Vitamin B12 deficiency
      - 2 3-Methylcrotonylglycinuria

DEFINITIONS

- **False Positive Rate:** *proportion of non-affected individuals who tested positive.*

  FPR = False positives/(False positives+True Negatives)

Performance Metrics

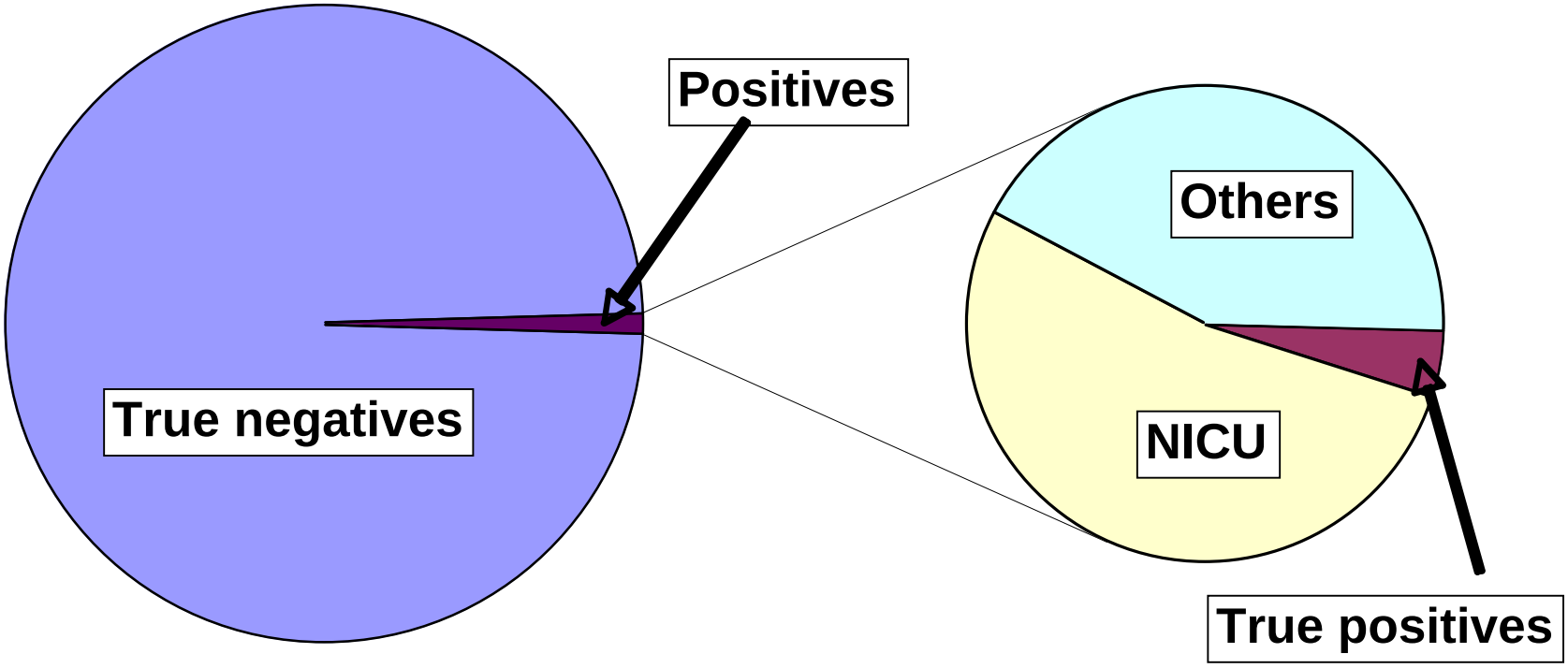
STATE/LAB	UTAH
PERIOD	2008
VOLUME	56,595

		STATUS		
		Affected	Not affected	TOTAL
TEST	POSITIVE	29	586	615
	NEGATIVE	0	55,980	55,980
	TOTAL	29	56,566	56,595

SENSITIVITY	100.00%	A/(A+C)	TP/(TP+FN)
SPECIFICITY	98.96%	D/(B+D)	TN/(FP+TN)
PPV	5%	A/(A+B)	TP/(TP+FP)
NPV	100%	D/(C+D)	TN/(FN+TN)

Pos detection rate	1 : 1,952	(Prevalence)
False positive rate	1.04%	FP/Population

Positive results: distribution



FACTORS AFFECTING NEWBORN SCREENING RESULTS

- **Intravenous hyperalimentation**
  - **Elevated amino acids**
  - **Dextrose**
- **Medications**
  - **Antibiotics (ampicillin, cefotaxime)**
- **Special diets**
  - **MCT oil**
- **Transfusions**

A protocol specific for pre-term and sick infants will reduce the false positive rate, yet assuring adequate testing.

Protocol for “sick” and “preterm” infants

- **COLLECT FIRST SCREENING SPECIMEN AT 0-48 HOURS OF AGE.**
  - If possible collect specimen before treatment is started or transfusion is given. Otherwise, collect at 24-48 h of age.
  - Antibiotics, TPN, other treatments and whole blood transfusion (packed red blood cells, whole blood) can interfere with the interpretation of the screening results.

Protocol for “sick” and “preterm” infants

- **COLLECT SECOND SCREENING SPECIMEN AT 8 DAYS OF AGE**, if still in the nursery or in the newborn icu.
  - Those babies who are discharged prior to 8 days of age should follow the routine collection requirement of collecting specimen between 7 and 28 days of age.

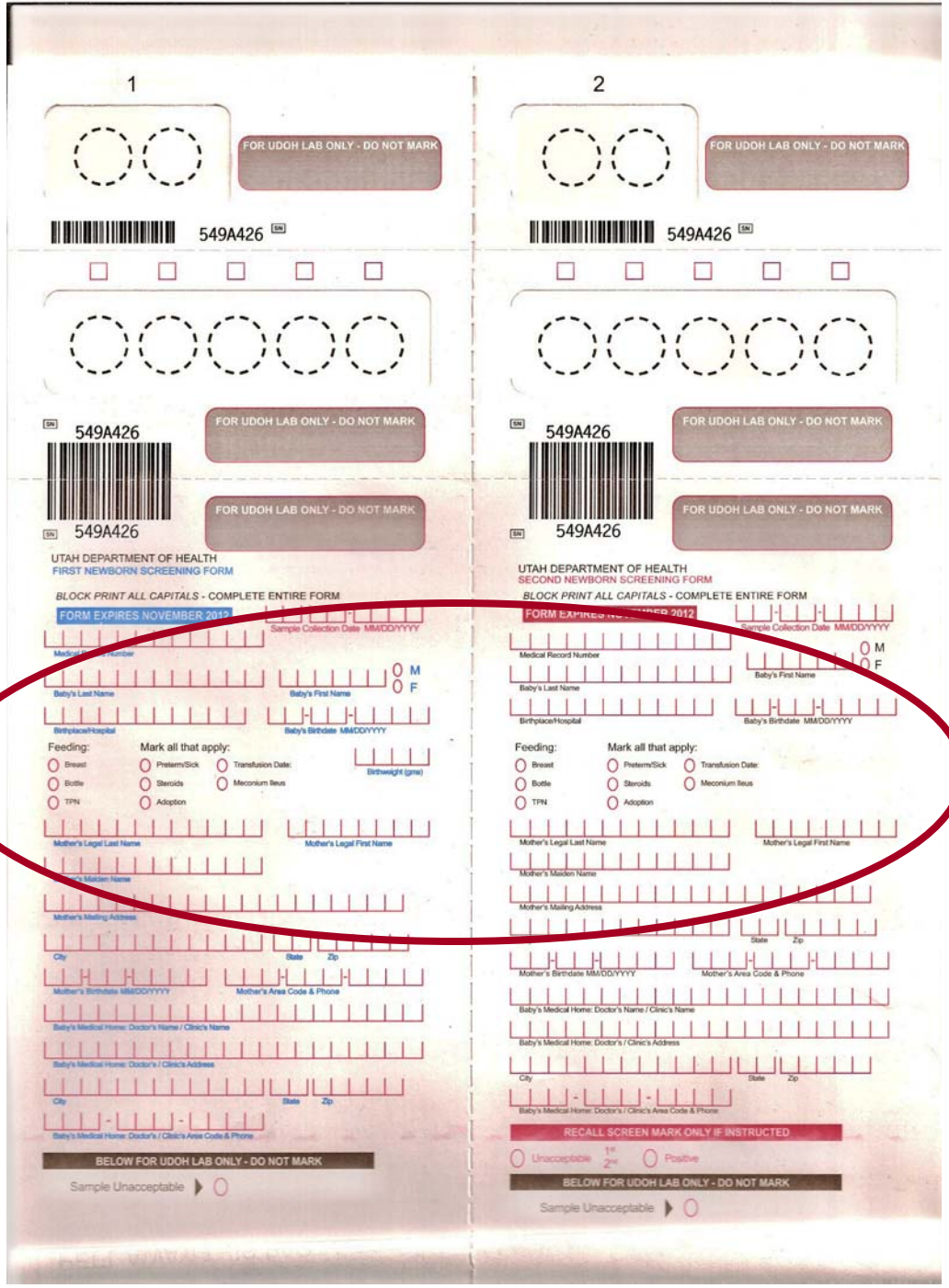
Protocol for “sick” and “preterm” infants

- **Screening results that reflect the medical state of the sick or preterm newborn will be reported as such, but not called to the Newborn ICU or nursery.** Your facility will receive the Newborn Screening Mailer as determined by each facility’s protocol.

- A notification will be made to the Newborn ICU or nursery if a third specimen is required or if there is clear evidence of a metabolic disorder.

Protocol for “sick” and “preterm” infants

- Clearly indicate on the screening collection data form the pertinent clinical information – i.e. mark the ‘sick/preterm’ box, TPN feeding, transfusion and date as applicable.
  - Noting the clinical information allows the program to interpret the results correctly and help to differentiate between a possible disorder and a reflection of the medical state of the sick or preterm newborn.



1

FOR UDOH LAB ONLY - DO NOT MARK

549A426 SN

549A426 SN

FOR UDOH LAB ONLY - DO NOT MARK

549A426 SN

549A426 SN

FOR UDOH LAB ONLY - DO NOT MARK

UTAH DEPARTMENT OF HEALTH
FIRST NEWBORN SCREENING FORM

BLOCK PRINT ALL CAPITALS - COMPLETE ENTIRE FORM

FORM EXPIRES NOVEMBER 2012

Sample Collection Date MM/DD/YYYY

Medical Record Number

Baby's Last Name

Baby's First Name

M
F

Birthplace/Hospital

Baby's Birthdate MM/DD/YYYY

Feeding:

Breast
Bottle
TPN

Mark all that apply:

Preterm/Sick
Steroids
Adoption
Transfusion Date:
Meconium Ileus

Birthweight (gms)

Mother's Legal Last Name

Mother's Legal First Name

Mother's Maiden Name

Mother's Mailing Address

City

State

Zip

Mother's Birthdate MM/DD/YYYY

Mother's Area Code & Phone

Baby's Medical Home: Doctor's Name / Clinic's Name

Baby's Medical Home: Doctor's / Clinic's Address

City

State

Zip

Baby's Medical Home: Doctor's / Clinic's Area Code & Phone

BELOW FOR UDOH LAB ONLY - DO NOT MARK

Sample Unacceptable

2

FOR UDOH LAB ONLY - DO NOT MARK

549A426 SN

549A426 SN

FOR UDOH LAB ONLY - DO NOT MARK

549A426 SN

549A426 SN

FOR UDOH LAB ONLY - DO NOT MARK

UTAH DEPARTMENT OF HEALTH
SECOND NEWBORN SCREENING FORM

BLOCK PRINT ALL CAPITALS - COMPLETE ENTIRE FORM

FORM EXPIRES NOVEMBER 2012

Sample Collection Date MM/DD/YYYY

Medical Record Number

Baby's Last Name

Baby's First Name

M
F

Birthplace/Hospital

Baby's Birthdate MM/DD/YYYY

Feeding:

Breast
Bottle
TPN

Mark all that apply:

Preterm/Sick
Steroids
Adoption
Transfusion Date:
Meconium Ileus

Mother's Legal Last Name

Mother's Legal First Name

Mother's Maiden Name

Mother's Mailing Address

State

Zip

Mother's Birthdate MM/DD/YYYY

Mother's Area Code & Phone

Baby's Medical Home: Doctor's Name / Clinic's Name

Baby's Medical Home: Doctor's / Clinic's Address

City

State

Zip

Baby's Medical Home: Doctor's / Clinic's Area Code & Phone

RECALL SCREEN MARK ONLY IF INSTRUCTED

Unacceptable 1st 2nd Positive

BELOW FOR UDOH LAB ONLY - DO NOT MARK

Sample Unacceptable

Please mark all of the following for an accurate interpretation of screen results.

Feeding:

- ○ Breast
- ○ Bottle
- ○ TPN

Mark all that apply:

- ○ Preterm/Sick
- ○ Steroids
- ○ Adoption
- ○ Transfusion Date:
- ○ Meconium Ileus

NBS INTERPRETATION FOR INFANTS WITH ABNORMALITIES CONSISTENT WITH CLINICAL STATUS/PREMATURITY

Newborn Screening Program

Unified State Laboratories: Public Health
4431 South 2700 West
Taylorsville, UT 84119-8600
Telephone: (801) 965-2400
FAX: (801) 969-3238

ACME HOSPITAL
ATTN: LAB RESULTS
123 ABC LANE
ANYWHERE UT 84123-4567

BABY

Infant's Name :	BABY NAME
Sex :	MALE
Birth Date :	XX/XX/2010
Birth Record # :	123X123
Hospital MR # :	
Mother's Name :	MOM NAME

SPECIMEN INFORMATION

Type :	FIRST
Ascn Number :	F999999999999
Date Collected :	03/23/2010
Date Received :	03/25/2010
Date Reported :	03/29/2010
Date Printed :	04/06/2010

NEWBORN SCREENING RESULTS

DISORDER/*TEST*	DATE TESTED	RESULTS	DETERMINATION/ *NORMAL RANGE*
Biotinidase Deficiency *Enzyme activity*	03/26/2010	Normal	Normal *Full enzyme activity*
Congenital Adrenal Hyperplasia * *17-OHP ELISA*	03/26/2010	13.4 ng/dL	Normal *Based on baby's birth weight*
Cystic Fibrosis *Immuno-reactive Trypsinogen ELISA*	03/26/2010	Normal	Normal *Full enzyme activity*
Galactosemia *G-1-P uridyltranzferase activity*	03/26/2010	11.8 U/gHb	Normal *> 3.0 U/gHb*
Hemoglobinopathies *Isoelectric Focusing*	03/26/2010	Normal - FA	Normal *FA (Fetal Adult)*
Congenital Hypothyroidism *TSH*	03/26/2010	1.4 µU/mL	Normal *1 - 40 µU/mL*
Acylcarnitine Disorders *MS/MS Tandem Mass screening*	03/29/2010	See note	SEE NOTE *Based on baby's birth weight*
Amino Acid Disorders *MS/MS Tandem Mass screening*	03/29/2010	Normal	Normal *Based on baby's birth weight*

* Caution should be used in interpreting the Congenital Adrenal Hyperplasia result if glucocorticoids have been given to infant or mother.

Specimen Comments:

In this sample the concentration of several acylcarnitines was elevated, with a pattern most consistent with intravenous hyperalimentation, medications, and/or dietary supplements other than with a metabolic disorder. A repeat screen should be performed to verify normalization of these values. ACTION: REPEAT SCREEN

In this sample the concentration of several amino acids (acylcarnitines) was elevated, with a pattern most consistent with intravenous hyperalimentation, medications, and/or dietary supplements other than with a metabolic disorder. A repeat screen should be performed to verify normalization of these values.

ACTION: REPEAT SCREEN

SUMMARY

- **A newborn screening protocol for "sick" and premature infants will start on April 12, 2010.**
- **Collection of samples:**
  - **Sick and premature infants should ALWAYS be screened at 24-48 hours of age, possibly before starting medications/supplements/intravenous hyperalimentation.**
  - **A second screen should ALWAYS be collected at 8 days of age independently from the results of the first screen.**

SUMMARY (2)

- **Reporting of results:**
  - **Results from the first screen sample consistent with administration of medications/supplements/intravenous fluids will be indicated in the report with the recommendation to collect a second screen, but WILL NOT BE CALLED to the nursery/physicians. These results will be reported to the birthing facility according to the facility protocol.**
  - **Results from the first screen sample suggestive of a metabolic disorder WILL BE CALLED immediately.**

SUMMARY (3)

- **Reporting of results:**
  - **Results from the second screen sample requiring an additional screen or additional tests WILL BE CALLED to the nursery/physicians.**

CONTACT INFORMATION

Fay A Keune RN BSN
Program Manager
Newborn Screening Program
44 N Mario Capecchi Dr
PO Box 144710
Salt Lake City UT 84114-4710
phone: (801) 584-8255
fax: (801) 536-0966
fkeune@utah.gov
website: health.utah.gov/newbornscreening/
Office Hours: Mon-Thur 7:00 AM to 6:00 PM

Harper Randall, MD
Medical Director,
CSNCN & MCH Bureaus, UDOH
44 N Mario Capecchi Drive
PO Box 144610
Salt Lake City, UT 84114-4610
phone: (801) 584-8271
harperrandall@utah.gov

Nicola Longo MD PhD
Professor and Chief
Medical Genetics/Pediatrics
University of Utah
2C412 SOM, 50 N Mario Capecchi Drive
Salt Lake City UT 84132
801 585 2457
801 587 7690 (Fax)
Nicola.Longo@hsc.utah.edu

Marzia Pasquali, PhD
Professor of Pathology
Medical Director, Biochemical Genetics and Supplemental Newborn Screening
ARUP Laboratories
500 Chipeta Way, Salt Lake City, Utah 84108
phone: (801) 583-2787, extension: 2853
fax: (801) 584-5207
pasquam@aruplab.com