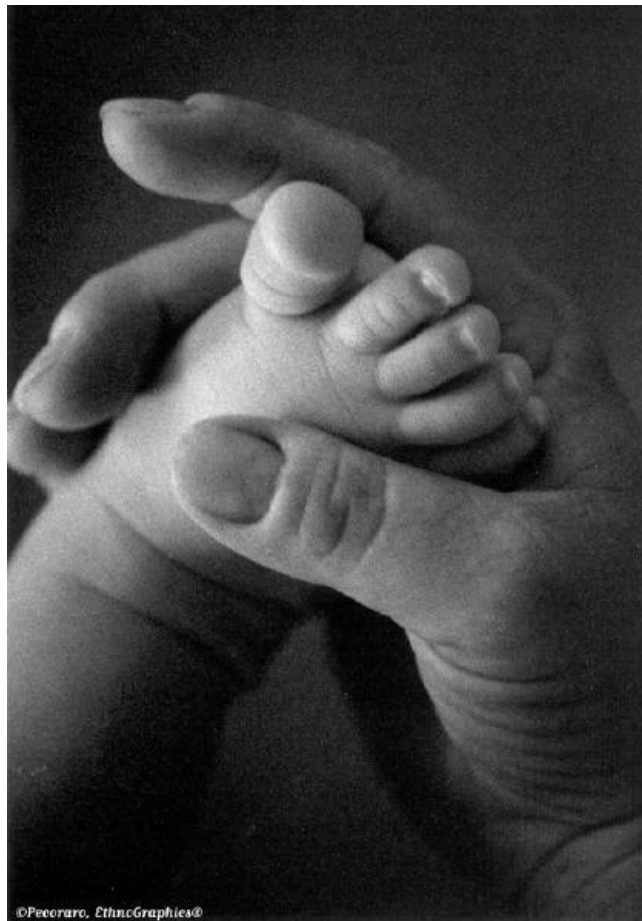


Maine Newborn Bloodspot Screening Program

PROVIDER MANUAL



Maine Department of Health and Human Services
Maine Center for Disease Control and Prevention
Newborn Bloodspot Screening Program
1-800-698-3624

Maine Newborn Bloodspot Screening Program Provider Manual

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MAINE NEWBORN BLOODSPOT SCREENING PROGRAM

Introduction

This manual was developed to educate and inform hospital personnel, physicians, midwives and other healthcare providers about the Maine Newborn Bloodspot Screening Program (MNBSP) as mandated by Maine State law, 22 MRSA, Chapter 261-A, Section §1532. It includes information on specimen collection techniques, proper completion of bloodspot filter paper forms, a discussion of the disorders screened for, and medical specialists serving your area.

The purpose of this manual is to promote a better understanding of the importance of screening, treatment for the disorders identified by screening, and coordination of services for evaluation and long-term care.

History

Public Health Genetics in Maine began in the 1960's, when, in 1962, thirteen Maine hospitals were selected to participate in a national Phenylketonuria (PKU) screening program funded by the Children's Bureau of the U.S. Department of Health, Education and Welfare. In 1965, the Maine State Legislature enacted legislation mandating the screening of all newborn infants for PKU. In 1976, Maine joined a regional effort for newborn screening and contracted with the Massachusetts State Laboratory for testing specimens for PKU and four other inborn errors of metabolism. Beginning July 1, 2001, Maine began mandatory testing to include nine disorders and offered an expanded optional panel of 19 additional disorders available on parent request. Effective January 1, 2006, all specimens submitted will be tested for all 28 disorders. Early treatment for these conditions can prevent mental retardation and other morbidity and mortality.

The Program encourages providers to refer to testing as "Newborn Screening," rather than "PKU Testing," as PKU is now only one of 28 tests performed, in addition to newborn hearing screening. It is important to emphasize that screening does not imply diagnosis, but is a means of identifying those at possible risk for a disorder requiring further follow-up. Access to genetic counseling and disorder management is available through agencies outlined in the "Resources and Contact Information" section of this manual.

Overview

The Maine Genetics Program is located within the Maine Department of Health and Human Services, Maine Center for Disease Control and Prevention, (formerly Bureau of Health), in Augusta. The Genetics Program oversees the activities of the Maine Newborn Bloodspot Screening Program (MNBSPP) and the Maine Newborn Hearing Program. The Genetics Program administers grants to qualified agencies to provide comprehensive genetic services to individuals in Maine who have or are at risk for genetic conditions or birth defects. These services include risk assessment, laboratory and clinical diagnosis, genetic counseling, care coordination and referral for children identified by the screening programs. The Genetics Program provides education and training to professionals regarding genetics, newborn bloodspot screening and newborn hearing. The Program provides technical assistance to the 32 Maine birth hospitals for all activities of newborn screening, including quality assurance.

The Maine Newborn Bloodspot Screening Program staff is available to answer your questions and provide further educational assistance as needed. **Contact us at 1-800-698-3624 or 207-287-5357.**



ORDERING SUPPLIES

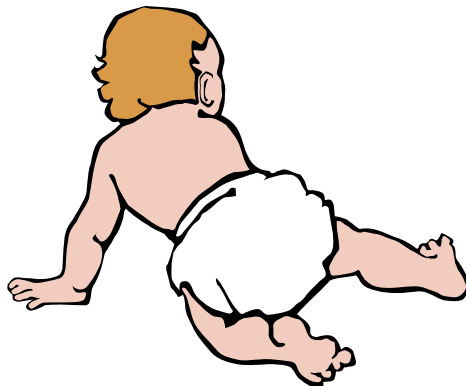
Filter Paper Kits for Maine Newborn Screening Blood Specimens: Filter paper kits for obtaining the blood specimen for newborn screening can be obtained through the Maine Health and Environmental Testing Lab - (207) 287-2727.

UPS Labels and Envelopes: Labels and envelopes for the UPS courier service can be obtained by contacting the MNBSP - (207) 287-5357 or 1-800-698-3624 or Fax (207) 287-4743.

Filter Paper Kits for Repeat Screening: Filter paper kits for requested or follow-up repeat screening are provided at no cost. Please contact the MNBSP - (207) 287-5357 or 1-800-698-3624 or Fax (207) 287-4743.

Filter Paper Kits for Diagnosed Children: Filter paper kits are provided at no cost to families of diagnosed children requiring frequent monitoring. The kits include instructions, filter papers, lancets, and postage-paid mailing envelopes. Families may contact the MNBSP at (207) 287-5357 or 1-800-698-3624 to request kits and supplies.

Maine Newborn Bloodspot Screening Program Brochures: Brochures describing the Maine Newborn Bloodspot and Hearing Screening Programs are available free to hospitals and providers for use with expectant and new parents. The Maine Newborn Bloodspot Screening brochure outlines and describes the disorders tested for in the Mandatory Panel. Please contact the MNBSP to request the brochures.



NEXT DAY DELIVERY COURIER SERVICES

In order that the affected infants are identified and treated early to prevent morbidity and mortality, a next day UPS courier delivery service has been established. Please be aware that this service is not available at the following locations: Calais Regional Hospital, Down East Community Hospital, Houlton Regional Hospital, and Millinocket Regional Hospital. These facilities should expect 2nd Day Air Delivery. Specimens are picked up at the hospital Monday through Friday and delivered the next business day to the screening lab.

UPS Designated Location and Contact Person: Each hospital will designate a contact person and pick up location within the hospital for the United Parcel Service (UPS) courier service.

Hospital Staff Responsibilities for UPS Next Day Courier Delivery: Daily Monday through Friday, hospital staff are responsible for:

- Collect all newborn screening blood specimens that have been dried according to recommended procedures.
- Place specimens in a next day air prepaid envelope with a prepaid label (both provided by the MNBSP) and left at the hospital's designated pick up location.
- The next day air envelope needs to be at the designated location by the specific time arranged with the UPS driver.
- Prepare only one envelope each day. More than one specimen can be put in an envelope.
- Maine Newborn Bloodspot Screening Program costs, and in turn, a facility's costs, are significantly increased when these procedures are not followed, i.e., more than one label/envelope per day or using supplies other than those provided by the MNBSP.

UPS Responsibilities for Next Day Courier Delivery: Daily Monday through Friday, the UPS driver goes to the designated location at the hospital to pick up the envelope. The specimens are then delivered next day to the New England Regional Newborn Screening Program in Jamaica Plain, Massachusetts, where the screening process begins.

Saturday and Sunday Shipments: Saturday and Sunday blood specimens are batched together with the Monday specimens in one envelope and picked up on Monday.

Holiday Pickups: Special arrangements are made for holiday pickups and facilities will be notified one week in advance by the MNBSP.

Specimens for Maine Newborn Bloodspot Screening Taken at Other Locations Within the Hospital: Any blood specimen taken for the MNBSP in other locations, i.e., patient room, procedure room, lab, etc., within the hospital should be dried and included in the envelope for daily UPS pick up. Contact the hospital nursery or perinatal nurse manager for the specific location and time.

Specimens for Maine Newborn Bloodspot Screening taken Outside the Hospital: Blood specimens taken at any location outside the hospital may be taken to the hospital for inclusion in the envelope for daily UPS pick up. Contact the hospital nursery or perinatal nurse manager for the specific location and time.

Specimens for Maine Newborn Bloodspot Screening Program Mailed Directly to Screening Lab: Blood specimens not included in the daily UPS hospital pick up, i.e., from a provider's office, should be mailed directly to the New England Newborn Screening Program in a pre-addressed envelope. If this envelope is unavailable, please contact the MNBSP or mail the specimen to:

New England Newborn Screening Program
University of Massachusetts Medical School
305 South Street
Jamaica Plain, MA 02130-3597.



COMPLETION OF THE FILTER PAPER PRIOR TO COLLECTION

In order to avoid delays in processing specimens and reporting of results, the MNBSP requests that individuals collecting newborn screening specimens ensure information on the filter paper cards is as complete and accurate as possible. It is very important that all areas be filled out as indicated. Failure to provide the full name, address and telephone number of the infant's primary care provider can result in a delay of notification of an abnormal result that may require prompt evaluation. It is essential to provide the dates and times of the infant's birth and when the specimen was collected. This information assists in determining if an infant was less than 24 hours of age at the time of specimen collection. It is also important in determining the infant's exact age in the event of an out-of-range result that requires evaluation. Please indicate in the "Comment" section if an infant has received a transfusion or total parenteral nutrition (TPN) prior to specimen collection, as this may affect results. In addition, Maine law requires that a notation be made in an infant's medical record, and in discharge information to parents, indicating when a newborn screening specimen was collected.

Please complete the filter paper card in all areas as indicated.

- ❖ Indicate if first or repeat specimen
- ❖ Hospital of Birth
- ❖ Check if birth hospital is the submitter of the card
- ❖ Baby's hospital medical record number
- ❖ Birth mother's name and date of birth
- ❖ Mother's address and telephone number
- ❖ Baby's doctor for care after discharge from facility
- ❖ Complete this provider's name, address and telephone number
- ❖ Baby's name and sex
- ❖ Indicate if single or multiple birth and assign letter (A, B or C) for multiple births
- ❖ Birth date and time, indicate if AM or PM
- ❖ Specimen collection date and time, indicate if AM or PM
- ❖ Birth weight
- ❖ Current weight at time of specimen collection
- ❖ Indicate if baby is less than 24 hours old
- ❖ Indicate if baby has been transfused in the last 48 hours
- ❖ Indicate if baby is in Special Care (NICU)
- ❖ Provide feeding status at time of discharge: breast, formula or both
- ❖ Location where specimen was collected
- ❖ COMMENTS: Provide any information helpful to lab or MNBP staff. If baby is to be adopted, please provide name of adoptive mother

and address. Information regarding family history of a disorder, reason for a repeat screening test, etc., may be included in this area. Additional information may be written on a separate note and attached to the filter paper card.

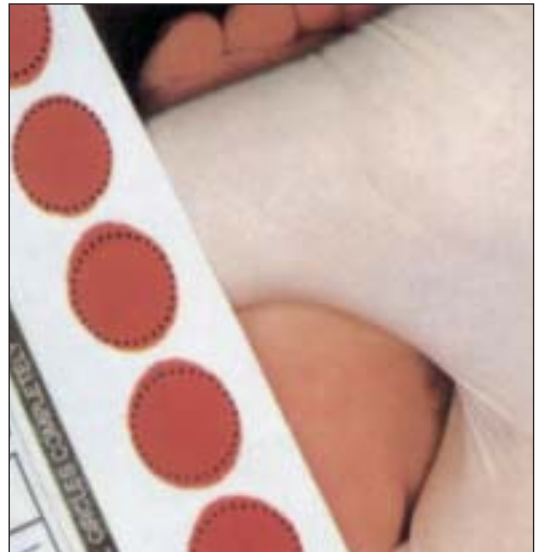




6 Puncture heel. Wipe away first blood drop with sterile gauze pad. Allow another LARGE blood drop to form.



7 Lightly touch filter paper to LARGE blood drop. Allow blood to soak through and completely fill circle with SINGLE application to LARGE blood drop. (To enhance blood flow, VERY GENTLE intermittent pressure may be applied to area surrounding puncture site). Apply blood to one side of filter paper only.



8 Fill remaining circles in the same manner as step 7, with successive blood drops. If blood flow is diminished, repeat steps 5 through 7. Care of skin puncture site should be consistent with your institution's procedures.



9 Dry blood spots on a dry, clean, flat non-absorbent surface for a minimum of four hours.



10 Mail completed form to testing laboratory within 24 hours of collection.

Information provided by The New York State Department of Health.

Schleicher & Schuell BioScience, Inc. • 10 Optical Avenue • Keene N.H. 03431 USA • Tel. (603) 352-3810 • Fax (603) 355-6524 • www.s-and-s.com • solutions@s-and-s.com
 Schleicher & Schuell BioScience GmbH • P.O. Box 1160, D-37582 Dassel • Germany • Tel. 49-5561-791-676 • Fax 49-5561-791-583 • www.s-und-s.de • salesdiagcomp@s-und-s.com

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Simple Spot Check

Valid Specimen



Allow a sufficient quantity of blood to soak through to completely fill the pre-printed circle on the filter paper. Fill all required circles with blood. Do not layer successive drops of blood or apply blood more than once in the same collection circle. Avoid touching or smearing spots.

Invalid Specimens:



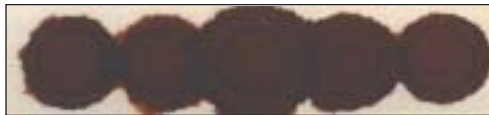
1. Specimen quantity insufficient for testing



2. Specimen appears scratched or abraded.



3. Specimen not dry before mailing.



4. Specimen appears supersaturated.



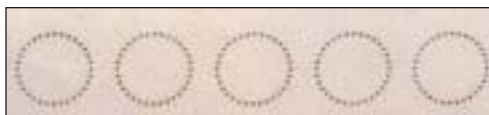
5. Specimen appears diluted, discolored or contaminated.



6. Specimen exhibits serum rings.



7. Specimen appears clotted or layered.



8. No blood.

Possible Causes:

- Removing filter paper before blood has completely filled circle or before blood has soaked through to second side.
- Applying blood to filter paper with a capillary tube.
- Touching filter paper before or after blood specimen collection with gloved or ungloved hands, hand lotion, etc.
- Allowing filter paper to come in contact with gloved or ungloved hands or substances such as hand lotion or powder, either before or after blood specimen collection.
- Applying blood with a capillary tube or other device.
- Mailing specimen before drying for a minimum of four hours.
- Applying excess blood to filter paper, usually with a device.
- Applying blood to both sides of filter paper.
- Squeezing or “milking” of area surrounding the puncture site.
- Allowing filter paper to come in contact with gloved or ungloved hands or substances such as alcohol, formula, antiseptic solutions, water, hand lotion or powder, etc., either before or after blood specimen collection.
- Exposing blood spots to direct heat.
- Not wiping alcohol from puncture site before making skin puncture.
- Allowing filter paper to come in contact with alcohol, hand lotion, etc.
- Squeezing area surrounding puncture site excessively.
- Drying specimen improperly.
- Applying blood to filter paper with a capillary tube.
- Touching the same circle on filter paper to blood drop several times.
- Filling circle on both sides of filter paper.
- Failure to obtain blood specimen.

Information provided by The New York State Department of Health.

COMMON CAUSES OF UNSATISFACTORY SPECIMENS

TYPE	POSSIBLE CAUSES	HOW TO AVOID
Quantity Not Sufficient	<p>The drops of blood are too small due to inadequate heel puncture.</p> <p>Removing filter paper before the blood has completely filled the circle or before the blood has soaked through to the second side.</p> <p>Applying blood to filter paper with a capillary tube.</p>	<p>Use approved collection techniques as outlined by NCCLS.</p> <p>Warm the infant's heel before the heel puncture to encourage blood flow. Use gentle pressure on the infant's heel to assure spontaneous free flow of blood.</p> <p>Allow a large drop of blood to form before touching the filter paper.</p> <p>Apply blood directly from the infant's heel to the filter paper, i.e., do not use a capillary tube for the blood collection.</p>
Supersaturated (too much blood soaking filter paper)	<p>The drops of blood are too large and overlap.</p> <p>The filter paper is pressed directly against the puncture site.</p> <p>More than one drop of blood is applied to a single circle.</p>	<p>Use a drop of blood that fills, but does not overflow the circle.</p> <p>Apply the blood to the filter paper without pressing it directly against the heel.</p> <p>Fill each circle with a single, large drop of blood.</p>
Cells & Serum Separated	<p>Squeezing or "milking" the heel during specimen collection.</p> <p>Using the first drop of blood after initial heel puncture.</p> <p>Using clotted blood.</p> <p>Drying the specimen improperly.</p>	<p>Warm the infant's heel before the heel puncture to encourage blood flow. Use gentle pressure on the infant's heel to assure spontaneous free flow of blood.</p> <p>Gently wipe off the first drop of blood with a sterile gauze or cotton ball after initial heel puncture to avoid diluting blood sample.</p> <p>Do not apply clotted blood.</p> <p>Air dry specimens in a flat (horizontal) position for 2-6 hours at room temperature.</p>

COMMON CAUSES OF UNSATISFACTORY SPECIMENS

TYPE	POSSIBLE CAUSES	HOW TO AVOID
Clotted Specimen	<p>Improper puncture technique.</p> <p>Waiting too long for a drop of blood to form.</p> <p>Allowing the blood to clot.</p>	<p>Use approved technique as outlined by NCCLS.</p> <p>Work in a timely manner to prevent clotting of the blood before it is applied to the filter paper.</p> <p>Do not apply blood that has clotted.</p>
Poor soak	<p>Not enough blood was applied to properly saturate the filter paper.</p>	<p>Apply a large hanging drop of blood evenly to the filter paper.</p>
Layered	<p>Applying many small drops of blood to each circle.</p> <p>Applying blood with any type of capillary tube.</p> <p>Touching the blood drops when they are wet.</p>	<p>Fill circle evenly with one large drop of blood.</p> <p>Apply blood directly to the filter paper, i.e. never use a capillary tube for collection.</p> <p>Refrain from touching the sample after collection.</p>
Contaminated	<p>Uneven soaking through the filter paper caused by exposure to moisture, glove powder, touching the filter paper before collection or the use of hand creams or lotions.</p> <p>Surface of the filter paper is contaminated with alcohol, water, formula, urine, feces, hand lotion, spilled beverages, etc.</p>	<p>Store filter papers in a dry place in a vertical position. Place on a clean dry surface while completing the required patient information on the filter paper form.</p> <p>Clean infant's heel with alcohol prep and wipe dry before collecting sample.</p>
Too Early	<p>The specimen was collected before the infant was 24 hours of age.</p>	<p>Collect the specimen after the infant is at least 24 hours old, or if this is not possible, (i.e., infant discharged prior to this time) inform the provider and parent/s of the necessity of repeating the specimen as close to 3 days of age as possible, but within 7 days.</p>

COMMON CAUSES OF UNSATISFACTORY SPECIMENS

TYPE	POSSIBLE CAUSES	HOW TO AVOID
Heated	<p>Specimen appears much darker than usual and appears to have been heated. Caused by too much time in transit, especially during summer.</p> <p>Heating specimen to dry it.</p>	<p>Send to lab via UPS Next Day Air.</p> <p>Air-dry specimen in a flat, horizontal position.</p> <p>Never heat specimen. Avoid exposure to direct sunlight.</p>
Both Sides	<p>Applying blood to both sides of the filter paper. It is easily recognized by holding the specimen up to a light and looking at both sides for shadows.</p>	<p>Apply blood to only one side of filter paper.</p>



Quick Reference Guide for Commonly Asked Questions

When is the best time to collect the initial blood specimen?

- **Term Newborn**

The most accurate specimen is usually taken by 3 days of age or at the time of discharge; whichever comes first. If the infant is discharged before 24 hours of age, take a specimen before the infant goes home. State law requires this specimen. Since a specimen taken before 24 hours of age may not give complete information about the likelihood of the infant having a condition, remind the parents that it will be necessary to have the infant retested as close as possible to the third day of life, but at least within the first seven days of life.

- **Preterm, Sick or Other Infants in Intensive Care**

The most accurate specimen should be collected on the third day of life regardless of feeding status, with a second specimen taken at 2 weeks of age or at discharge, whichever is earlier, unless otherwise indicated. (Refer to section 7.0 of the Rules and Regulations regarding testing of newborn infants.) The repeat specimen should be collected at two weeks of age for any preterm, sick or intensive care infant to verify that clinically significant results were not masked by medications, transfusions or other treatments.

Whenever possible, collect an initial specimen prior to the start of antibiotics or hyperalimentation, regardless of age. **A specimen should never be taken from an intravenous line used to deliver hyperalimentation. Additionally, obtaining a specimen from a central venous line is discouraged due to the possibility of contamination with EDTA (ethylenediaminetetra acetic acid) or heparin.**

Use of hyperalimentation is frequently associated with multiple elevations in amino acids, such as leucine, phenylalanine and methionine. Such elevations also occur with many of the amino acid disorders. Collect a repeat specimen 72 hours after discontinuation of hyperalimentation.

- **Transfers to Other Facilities**

The transferring facility (birth hospital) is responsible for obtaining the initial specimen. In the event of a transfer before this specimen can be obtained, the second facility shall obtain the initial specimen. The name of the birth facility should be noted on the lab slip, as well as the name of the facility the infant was transferred to. Please notify the Newborn Bloodspot Screening Program of any transfers to other facilities within 5 days. A copy of the Notification of Hospital Transfer form is included at the end of this manual.

- **How Long After a Blood Transfusion is the Optimal Time to Collect a Blood Specimen?**

Ideally, if it seems likely that the infant will receive a blood transfusion, then collect the blood specimen **before** the transfusion, regardless of age. If this is not possible, then the most accurate sample should be collected within 3 to 7 days after the transfusion. Transfusions can mask some disorders and will require a repeat Newborn Screen 2 months after the last transfusion was given.

What is the Procedure When a Parent Refuses Testing?

A religious refusal is the only accepted exemption from newborn screening. Refusals should be rare and initiated by the parents. A refusal should not be offered as an alternative to testing prior to early discharge. Make sure the parents have been informed of the risk of possible consequences of untreated disorders. Review with the parents the newborn bloodspot screening brochure and educational materials provided by the MNBSP. If the parents continue to present a **genuine religious** objection to testing, notify the child's primary care provider and have the parents sign the Refusal Form (provided in Section 6, page 56). This form should be sent via mail or fax to the Newborn Bloodspot Screening Program within 14 days of the infant's birth. A copy should become a permanent part of the infant's medical record. (Refer to Sections 1.0 and 9.0 of the Rules and Regulations relating to the testing of newborn infants, see Section 6 pages 49 & 53 of this manual.)

What are the Most Common Mistakes that Result in Unsatisfactory Specimens?

- Not wiping away the first drop of blood after the initial heel stick puncture.
- Applying blood to both sides of the filter paper.
- Using more than one drop of blood to fill a circle.
- Squeezing or milking the foot to enhance blood flow.
- Touching the filter paper to a baby's heel.
- Scratching the filter paper with a capillary tube when applying blood. Never use a capillary tube to collect a specimen.
- Contamination of filter paper and/or specimen with substances such as glove powder, lotion, urine, etc.
- Not allowing specimens to be air-dried adequately before shipping.
- Heat and humidity can damage the specimen by destroying enzyme activity.
- Do not ship specimen in a biohazard bag. This can alter components of the blood (analytes) and/or enzyme activity.

How Many Circles Need to Be Filled Out for a Repeat Specimen?

All circles need to be filled when repeating a specimen regardless of the disorder being retested, unless directed otherwise by MNBSP staff.

What if the Baby Was Born Out of State?

The primary care provider should check the medical record for any infant less than 3 months of age to see if the child has had a specimen collected in the State of birth. If none is noted in the medical record, a specimen will need to be submitted for testing through Maine's Newborn Bloodspot Screening Program. (Refer to Section 5.1 of the Rules and Regulations relating to the testing of newborn infants, see Section 6, page 52 of this manual.)

Who Will Inform the Parents of the Results of the Screening Test?

If any of the screening tests are abnormal or unsatisfactory, the MNBSP staff will contact the infant's primary care provider (as indicated on the filter paper form). The primary care provider will be informed of the test results, implications, and the next steps necessary. A repeat specimen is often requested. It is the responsibility of the primary care provider to notify the parents of the newborn screening results and necessary follow-up. If no primary provider is available, or if the parents have chosen a different provider than listed on the filter paper form, the MNBSP staff may contact the parents directly and discuss the newborn screening results.

In the case of results that require immediate action, (indicating a high risk of a disorder), the MNBSP will contact one of its medical specialists. These are physicians specializing in the care of metabolic, endocrine or hemoglobin disorders. This medical specialist will then contact the infant's primary care provider and inform him/her of the recommendations for appropriate emergency and follow-up care of the infant. At this time, the providers will collaborate regarding who will inform the parents. Occasionally, if the primary care provider requests, or is unavailable, a medical specialist may contact a parent directly to discuss the screening results, evaluation and possible treatment.

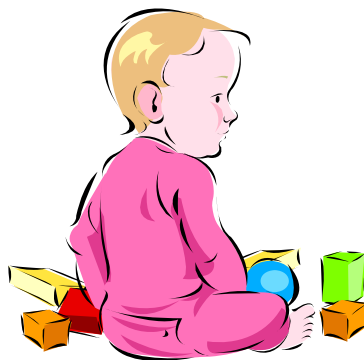
The MNBSP will mail reports of all normal screening results to the primary care provider's office (listed on the filter paper form) before the infant is two weeks of age.

What If the Baby Is Adopted?

When an infant is being placed for adoption, it is important that the MNBSP be able to accurately identify and locate the infant if screening indicates that follow-up and treatment are required. All information provided on the filter paper form is kept confidential. If you have any questions about a special situation, or what information is needed, please contact MNBSP staff. Obtaining the specimen after 24 hours of age will minimize the need for a required repeat specimen.

The person completing a newborn screening filter paper specimen card shall supply the following information:

- Birth mother's name should be listed as Mother. In the comment section, it should be noted "ADOPTION." If the adoptive family is known and will have custody of the infant after discharge, this name should be written in the comments section also with the phone number.
- If the adoption is arranged through an agency and the adoptive family name is unknown, the agency name and number should be written in the comments section with phone number.
- The physician who will be following the infant after discharge should be listed. If this physician is not known, write the name of the current physician, or agency case manager, or other person who will have information about how to locate the infant and a responsible adult.



SCREENING TESTS PERFORMED

Disorders Included in Mandatory Screening Panel

As required by law, Maine tests all specimens for the following disorders (other disorders may be added as effective screening procedures and treatment become available):

Biotinidase Deficiency: This disorder is caused by the lack of an enzyme called biotinidase. This disorder can lead to seizures, developmental delay, eczema, and hearing loss. *Problems can be prevented with biotin treatment.*

Congenital Adrenal Hyperplasia (CAH): This disorder is caused by the lack of an enzyme that the adrenal gland uses to process hormones. Serious loss of body salt and water, even death, may occur in either boys or girls. Some girls' genitals may look more like a boy's. *Treatments are available to manage this disorder.*

Congenital Hypothyroidism: This disorder is caused by the lack of thyroid hormone, which can lead to poor growth and mental retardation. *Early treatment with thyroid medication can lead to normal growth and development.*

Galactosemia: This disorder is caused when the body cannot break down a sugar (galactose) contained in milk. In some cases, life-threatening damage to the brain and liver can occur as early as one week after birth. *When started early, a special milk-free diet helps prevent these problems.*

Hemoglobin Disorders: Each of these disorders is caused by a change in the red blood cells. An example is Sickle Cell Disease. Sickle Cell Disease can cause the baby to have anemia, pain, strokes and life-threatening infections. *Special medical care begun early in life increases the chances for avoiding these problems.*

Homocystinuria (HCU): This disorder is caused when the body is not able to change one amino acid into another. The amino acid homocystine builds up in the blood. This disorder can lead to mental retardation, eye problems and blood clots. *When detected early, the baby is put on a special diet to help avoid these problems.*

“Maple Syrup” Urine Disease (MSUD): This disorder is caused when the body is not able to break down several amino acids, which are found in the protein in foods. It can result in mental retardation, seizures or death. The baby's urine smells like maple syrup. *When detected early, the baby is put on a special low protein diet to help avoid the severe effects of the disease.*

Medium-chain Acyl Co-A Dehydrogenase Deficiency (MCAD): This disorder is caused by a lack of an enzyme that breaks down fat stored in the body. When an infant “fasts” (goes for a long period of time without eating), this can cause problems because the infant cannot use stored fat properly. This kind of metabolic crisis can sometimes lead to seizures, failure to breathe, cardiac arrest, and death. *Treatment is effective and focuses on preventing long fasts.*

Phenylketonuria (PKU): This disorder is caused when the body is not able to break down the amino acid, phenylalanine, which is found in the protein in foods. PKU results in mental retardation. *When detected early and the baby is started on a special low phenylalanine diet, mental retardation is prevented.*

Amino Acid Disorders: Tyrosinemia Type I and II: These disorders are caused when the body is not able to break down the amino acid, tyrosine, which is found in the protein of foods. This may cause liver failure (type I), or problems with eyes, skin or growth development (type II). *Treatment includes a special diet, medications (type I and II), and in some cases, a liver transplant (type I).*

Urea Cycle Disorders: Argininemia, Argininosuccinic Aciduria, Citrullinemia and “HHH” Syndrome: These disorders are caused by a toxic buildup of ammonia in the blood. This happens when the body cannot break down certain amino acids, which are found in the protein of foods. This could lead to coma or death. *Treatment is with a special diet and medications.*

Fatty Acid Oxidation Disorders – SCAD, LCAD, LCHAD, VLCAD, CPT II and Glutaric Acidemia Type II: These disorders are caused by the lack of enzymes that break down fat stored in the body. *These disorders are similar to MCAD (one of the nine required Newborn Screening tests) and the treatment is similar.*

Organic Acid Disorders – Glutaric Acidemia Type I, Isovaleric Acidemia, Methylmalonic Acidemia, Propionic Acidemia.

Glutaric Acidemia Type I: This disorder is caused by a buildup of glutaric acid in the body. This happens when the body cannot break down the amino acids, leucine and tryptophan, which are found in the protein of foods. This can cause vomiting, seizures, coma and death. *Treatment includes a special diet and medications.*

Isovaleric Acidemia: This disorder is caused by a buildup of isovaleric acid. This happens when the body is unable to completely break down the amino acid leucine, which is found in the protein of foods. This can cause vomiting, coma and death. *Treatment includes a special diet and medications.*

Methylmalonic Acidemia (MMA): This disorder is caused by defects in the breakdown of organic acids. This can involve the lack of an enzyme or defects in the way vitamin B12 is made and carried through the body. This can cause poor feeding,

vomiting, failure to thrive and low muscle tone. *Treatment includes a special diet and medications.*

Propionic Acidemia (PPA): This disorder is caused by a buildup of propionic acid in the body. This happens when the body does not have enough enzymes to break down the propionic acid. This can cause poor feeding, vomiting, low muscle tone, seizures, coma and death. *Treatment includes a special diet and medications.*

Other Organic Acid Disorders: B-KT, MCC and HMG: These disorders are caused by the buildup of organic acids in the body, which can be toxic. This can cause vomiting, coma and death. *Treatment is usually a special diet and medications.*



Key Points for Providers About Newborn Screening and Notifying Parents of Screening Results

The goal of newborn screening is to identify infants at increased risk of a disorder and who need further evaluation or treatment. Infants should be identified at the earliest opportunity to allow for early and ongoing treatment to limit the negative effects of the disorder. Physicians/health care providers and families will receive accurate and appropriate information on screening results and their implications for the child's health. The program follows all infants to assure screening test is done and continues until all conditions are ruled out or the infant is in appropriate treatment.

MNBSP staff will contact the provider's office and discuss results, the implications for the child and recommend next steps. Next steps may include a repeat filter paper, evaluation or additional laboratory tests, or follow-up with a medical specialist. The provider will be requested to notify the infant's parents and coordinate follow-up testing as indicated.

Whenever possible, moderately or significantly out of range results will be reported to the primary care physician (as listed on the filter paper form) by a medical specialist contracted by the MNBSP. This physician may be a specialist in the care of metabolic, endocrine or hemoglobin disorders. If this would cause a delay in notification, i.e., instances of a delay in reaching the medical specialist and a result requiring urgent intervention, the results will first be reported by a nurse or physician associated with the program. This may include staff from the Maine Genetics Program, the New England Newborn Screening Program laboratory, or other program consultants. If the program staff are unavailable, i.e., weekend, furlough, or out of office, any urgent screening result will be reported by the screening laboratory to the responsible provider, and/or medical specialist, to prevent delays in diagnosis and treatment.

If the result represents a moderate or significant risk of a disorder, representatives of the MNBSP or the New England Newborn Screening Program laboratory will notify an appropriate medical specialist in Maine. This specialist will then contact the primary care provider directly regarding the test results, the likelihood of a disorder, implications for the child, necessary evaluation, laboratory tests and follow-up. Depending on the disorder, treatment may be coordinated by the primary care provider or by the medical specialist.

Significantly out of range results may indicate a medical emergency situation. The MNBSP will check with an appropriate medical specialist, and/or primary care provider, to confirm the family was located and repeat testing or evaluation plans are in place.

Any screening test provides a piece of the picture into the health of an infant at a specific point in time. In any situation where a child presents with symptoms of a disorder, a normal screening result should not delay further evaluation and diagnosis. Another specimen may be requested for testing as part of the evaluation and diagnostic process.

When contacting the parents of an infant about a screening result, please remember the following points:

- All new parents are anxious about the health of their baby.
- Parents need accurate and timely information.
- The Maine Newborn Bloodspot Screening Program includes many more disorders than PKU. Avoid calling it the “PKU Test”. This can cause confusion.
- This is a Screening Test. Results are not diagnostic for a disorder. An out of range result indicates further testing and follow-up are necessary.
- If the child needs additional testing or diagnostic evaluation, make certain that the parents understand the importance of following the recommendations of the specialist for additional testing and referrals.
- Avoid overly alarming them if the diagnosis has not yet been confirmed.
- An unsatisfactory specimen results when there is a problem with the condition of the specimen. It is not a test result. Most unsatisfactory specimens occur from contamination or improper collection technique. This results in a sample that is unable to be tested and another specimen will be needed.

When a diagnosis has been confirmed, these guidelines should be followed:

- Parents should understand that treatment is life long, and that compliance with dietary management and/or medication is imperative to the child’s health, growth, and development.
- Infants and children with an identified disorder should have regular follow-up appointments with a disease specialist. At the time of confirmation of a disorder, the Parents should be warned that if the infant shows MNBSP will refer the infant and family to an appropriate medical specialist and the Children with Special Health Needs Program. An individualized plan of care coordination will be developed. This includes determining eligibility for financial assistance and arrangements to attend appropriate specialty clinics.
- Parents should be warned that if the infant shows early signs of the condition, as described by the specialist, they should seek immediate medical attention for the child. A medical plan should be developed for these acute episodes.

- Long-term management, monitoring, and compliance with treatment recommendations are essential to the child's well being. A multi-disciplinary approach including the following specialties is recommended: pediatrics, genetics, nutrition, social and psychological services. The MNBSP works with the Maine Children with Special Health Needs Program to coordinate referrals with providers in these specialties. Family involvement and support are absolutely essential for lifelong success with management of the disorder.
- Genetic counseling services are recommended for confirmed and suspected carriers of a disorder.
- A list of available community support services should be provided. Early intervention service providers are able to provide evaluations and develop individualized plans of care to promote normal growth and development.
- For more information about newborn screening and specific disorders, contact the MNBSP at **1-800-698-3624**. Also see the Resources and Contact Info section of this manual, starting on page 41.



RESULTS REQUIRING FURTHER FOLLOW-UP

Unsatisfactory Specimens:

- √ A blood specimen is considered unsatisfactory for screening when the lab is not able to perform all screens on that specimen. Reasons might be poor soak, insufficient blood, layering, or contamination.

Questionable or Out of Range Results:

- √ Repeat specimens are requested.

Phenylketonuria (PKU):

- √ Repeat specimens requested for Phenylalanine values equal to or > 2.3 mg/dL

Hypothyroid – (Results dependent on age):

- √ T4: Repeat specimen requested for values < 5.0 ug/dL
- √ TSH: Repeat specimen requested for values > 20 uU/mL ~ laboratory adjusts for age

Galactosemia:

- √ Total Galactose – repeat specimen requested for values >14 mg/dL

Homocystinuria:

- √ Methionine – repeat specimen requested for values > 1.0 mg/dL

Maple Syrup Urine Disease (MSUD):

- √ Leucine – repeat specimen requested for values > 4.5 mg/dL

Biotinidase:

- √ Biotinidase – repeat specimen requested for values < 30 % of enzyme activity

Congenital Adrenal Hyperplasia (CAH):

- √ Results of 17-OHP are adjusted for weight. Repeat specimen is requested if results are out of range.

Hemoglobin Disorders:

- √ A repeat specimen is requested for results other than normal (FA, AF, A).
Abnormal results are Hgb variants or absence of Hgb A.

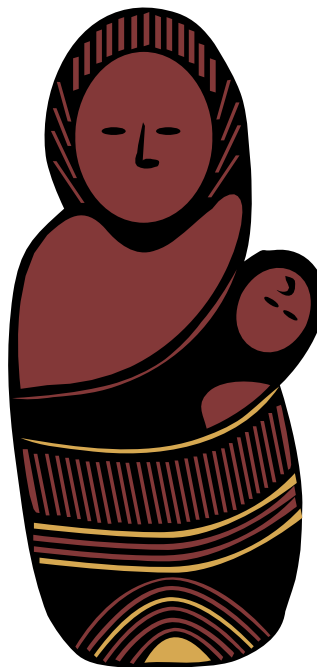
Medium-chain Acyl Co-A Dehydrogenase Deficiency (MCAD):

- √ Repeat specimen requested if C8 result > 0.5 umol/L.

Amino Acid Disorders, Fatty Acid Oxidation Disorders, Organic Acid Disorders:

- √ Repeat specimen is requested if any markers are out of range.

*Lab ranges subject to change as determined by State reference lab.



DIAGNOSTIC PROCESS

1. **Out of Range Results:** When such results are obtained, the New England Newborn Screening Lab contacts the MNBSP by phone and notifies of results that indicate a high risk for a disorder.
2. The MNBSP staff will then contact the primary care provider's office to notify of results obtained. At that time, a request will be made for the provider to assist the family in obtaining a repeat blood specimen. Written confirmation of this call will then be faxed and/or mailed.
3. **Urgent Situations:** In the event an unusually out of range result is obtained, indicating a high probability a disorder does exist and a possible life-threatening situation may arise, the MNBSP will notify its medical specialists as per Program protocol. The medical specialist will be provided all test result information, as well as demographic information for the infant, mother, hospital and primary care provider. The medical specialist will then contact the primary care provider and discuss these results, implications and possible treatment and arrange evaluations/referrals with an appropriate specialist. In the event the primary care provider is unavailable or unknown, the MNBSP staff or the medical specialist may contact the parents directly.
4. **Monitoring:** In the event the result is indeterminate or borderline, the MNBSP will continue to assist the primary care provider in monitoring results until a disorder is ruled out or treatment is initiated.

Referral System: In the event a disorder is suspected or confirmed, the MNBSP will initiate a referral to the medical specialist, a registered dietitian, community/public health nursing, if indicated, and the Children with Special Health Needs Program.

The Children with Special Health Needs Program (CSHN) is located within the Maine Department of Health and Human Services, Public Health. CSHN provides financially eligible families with assistance to help pay for specialty medical care, medications, dietary needs, equipment, and care coordination.

Public Health Nursing (PHN) is also located within the Maine Department of Health and Human Services, Public Health. PHN provides home visit services for children with special health needs, education on parenting, growth and development, pregnancy, breastfeeding support, and health and needs assessments at no cost. Services are provided by Registered Professional Nurses.

Repeat Specimens: When a repeat specimen has been requested and has not been received, the MNBSP will attempt to secure the specimen, depending on potential disorder, result and urgency. The provider will be notified by telephone

and written reminders. If deemed necessary, the following steps may occur: certified letter to the mother, referral to community or public health nursing. If there is still not a response after all reasonable attempts have been made, the file may be closed as “lost to follow-up.”



Congenital Hypothyroidism

Congenital Hypothyroidism results from an inadequate production of thyroid hormone, which may be due to a number of causes. Disorders of hormonogenesis may be inherited as autosomal recessive trait and may be X linked. There is a 3:1 sex ratio of females to males. Other causes of hypothyroidism include maternal radioiodine or iodine exposure, TSH or Thyroid Hormone Unresponsiveness, hypopituitarism and developmental defects of the thyroid gland. In newborn infants with congenital hypothyroidism, associated symptoms may vary in range of severity and rate of progression depending on degrees of thyroid hormone deficiency. Symptoms may range from infantile hypotonia, poor feeding and delayed stooling at birth to the classic signs of myxedema, protruding tongue, and poor peripheral circulation and bradycardia. Treatment should begin in the first few weeks of life to prevent permanent retardation of intellectual function and skeletal growth.

Prevalence:	1: 3,600- 1:5,000
Analyte Measured:	Thyrotropin (TSH)
Reporting Ranges:	Decreased T4 Elevated TSH
Feeding Effect:	None
Timing Effect:	< 24 hours of age: Repeat test >24 hours of age: Results are valid
Confirmation:	Repeat filter paper specimen. If results remain abnormal then Serum T4 and TSH levels are indicated.
Treatment:	Referral will be made to a Pediatric Endocrinologist. Initiate oral intake of thyroxin (dose is weight dependent). Additional treatment is symptomatic and supportive.
Comment:	Most newborns are asymptomatic due to the transplacental transfer of moderate amounts of maternal T4. Specimens should be obtained at 48 hours to avoid the TSH surge at birth due to stress producing false positive results. TSH levels return to normal adult levels in about 72 hours. Providers must be alerted to clinical symptoms in older infants despite normal newborn screening results.

Congenital Adrenal Hyperplasia (CAH)

CAH is a family of diseases whose common feature is an enzymatic defect in the steroidogenic pathway leading to the biosynthesis of cortisol. The 21-hydroxylase deficiency accounts for 90-95 percent of CAH cases, resulting in ambiguous genitalia in females and salt-losing crisis in either males or females. Early detection and treatment is essential to prevent death in infants with salt-losing CAH.

Prevalence:	1:12,000	
Analyte Measured:	17-hydroxyprogesterone (17-OHP)	
Reporting Ranges:	Reporting ranges are weight dependent	
Birth Weight (gm)	17-OHP (ng/ml)	
	Normal	
0-1500 gm	< 150	
1501-2000 gm	< 80	Repeats requested or follow-up per medical specialist for values > normals.
2001-2500 gm	< 60	
> 2500 gm	< 50	
Feeding Effect:	None	
Timing Effect:	False positive 17-OHP results may occur if sample is collected before 24 hours of age.	
Other Effect:	EDTA can cause a false positive screening result.	
Confirmation:	Repeat screen (for results of 'concern') or confirmatory test (for results that are 'urgent') as directed by program staff or pediatric endocrinology consultant.	

Treatment: Referral will be made to Pediatric Endocrinologist.
Glucocorticoids: to replace cortisol and suppress excessive corticotropin and androgen production.
Mineralocorticoids: for salt-losing and elevated plasma renin.
NaCl supplement: may be necessary.
Ambiguous genitalia: Surgery

Comment: Repeat of non-normal 17-OHP newborn screening tests by a “reference” laboratory other than the laboratory recommended by the pediatric endocrinologist may cause confusion in interpreting results due to different reporting methods.

Phenylketonuria (PKU)

Phenylketonuria is an inherited autosomal recessive disorder of phenylalanine metabolism. PKU is usually detected within the first few days of life by newborn screening. It is characterized by the absence or deficiency of an enzyme, phenylalanine hydroxylase, that allows phenylalanine to accumulate in the blood and is toxic to brain tissue. Early detection and treatment is essential to prevent associated neurological symptoms and mental retardation.

Prevalence:	1:11,000
Analytes Measured:	Phenylalanine
Reporting Ranges:	Elevated phenylalanine
Feeding Effect:	None
Timing Effect:	< 24 hours of age: Repeat screen within 7 days ≥ 24 hours of age: Results are valid
Confirmation:	Repeat newborn screen.
Treatment:	Referral is made to a Metabolic Specialist. Dietary restrictions of phenylalanine with regular monitoring of serum phenylalanine levels.
Comments:	Without treatment, most infants develop mental retardation that is usually severe. These infants may also develop additional neurological symptoms such as seizures, hyperactivity and aggressive behavior. With good dietary control and monitoring, these potential effects of PKU can be minimized.

Biotinidase Deficiency

Biotinidase deficiency is an autosomal recessive inherited disorder that results in the inability to process the vitamin biotin in the normal way. Early symptoms of biotinidase deficiency generally appear in infancy or early childhood and may include seizures, skin rash, hair loss, hypotonia, hearing loss, developmental delay and metabolic acidosis which can result in coma and death. The number of symptoms that a child develops and the severity of the disorder vary from child to child, even within the same family.

Prevalence:	1: 60,000- 1: 126,000
Analyte Measured:	Biotinidase enzyme
Reporting Ranges:	Enzyme absent or reduced
Feeding Effect:	None
Timing Effect:	No effect
Confirmation:	Repeat newborn screen. Colorimetric assay for biotinidase.
Treatment:	Referral is made to a Metabolic Specialist. Treatment includes daily Biotin supplements.
Comments:	With early diagnosis and treatment, all the symptoms of biotinidase deficiency can be prevented. Treatment with biotin supplements is relatively inexpensive and has been well tolerated to date. If left untreated biotinidase deficiency can cause coma leading to death. There is research pending to support the link with sudden infant death syndrome.

Galactosemia

Galactosemia is an inherited disorder of galactose metabolism. The main dietary source of galactose is lactose, which is found in milk. Clinical features of Galactosemia are failure to thrive (most common initial symptom), vomiting and diarrhea seen within a few days of birth after ingestion of milk. There is also an increased incidence of E.coli sepsis in untreated neonates. Early detection, proper diet and monitoring for signs of infection are essential to prevent death in infants with Galactosemia.

Prevalence:	1:60,000 – 1:80,000
Analyte Measured:	Free Galactose
Reporting Ranges:	Elevated Galactose-1-Phosphate Reduced Uridyl-1-transferase deficiency (GALT)
Feeding Effect:	Minimal – Classical galactosemic babies have elevated galactose-1-phosphate levels
Timing Effect	< 24 hours of age: Repeat within 7 days > 24 hours of age: Results are valid
Other Effect:	Potential for false positives due to the stability of transferase decreases in hot humid months. Blood transfusions may have a negative Beutler test for as long as 2-3 months.
Confirmation:	Quantitative measurement for galactose, galactose1- phosphate and starch gel electrophoresis for transferase enzyme. Check for galactosuria
Treatment:	Referral made to a Metabolic Specialist. Elimination of dietary lactose, including breast milk, cow's milk and /or lactose based infant formula.
Comment:	Symptoms may occur before receiving the results of the Newborn screening. A galactose-free diet and supportive care for E. coli sepsis, liver failure, and coagulation problems should be considered pending confirmation of the diagnosis.

Homocystinuria

Homocystinuria is an autosomal recessive disorder of methionine metabolism. The most common cause of homocystinuria is a deficiency of the amino acid cystathionine *B*-synthase. Due to this deficiency, elevated levels of homocystine, methionine and their metabolites accumulate in the blood and urine of these patients. Newborns appear normal and early symptoms are vague. Usually by age 3, more specific symptoms appear. An increase in visual problems leads to a diagnosis of this condition when a child on examination is discovered to have dislocation of the lens of the eye and severe myopia. Several clinical findings of homocystinuria have features similar of Marfan's syndrome including dislocation of the lens, tall thin build with elongated arms and legs and scoliosis. In addition, blood clots tend to develop and become lodged in any large or small blood vessel potentially leading to a life-threatening crisis.

Prevalence:	1: 50,000- 1: 200,000
Analyte Measured:	Methionine
Reporting Ranges:	Elevated Methionine
Timing:	Elevations may be minimal during the first 3 days of life until adequate protein intake (milk feedings).
Confirmation	A diagnosis is made in the presence of an increased homocysteine and increased methionine.
Treatment:	Referral will be made to a Metabolic Specialist. Treatment is aimed at the underlying cause of homocystinuria. A methionine-restricted, cystine-supplemented diet is indicated. Anticoagulant therapy is indicated.
Comment:	Without proper treatment, 65%- 80% of patients have developmental delays and approximately 50% of patients die by the age of 25. Death is frequently associated with arterial or venous thromboses that involve the cerebral, pulmonary, renal, and myocardial circulation. However, treatment reduces the risk of thromboembolic episodes and the incidence of mental retardation and seizures are greatly reduced.

Maple Syrup Urine Disease (MSUD)

Maple Syrup Urine Disease is an autosomal recessive disorder caused by the inability to metabolize the amino acids leucine, isoleucine and valine. This disease is so named because the urine of affected people smells like maple syrup. Early neonatal symptoms include poor feeding, lethargy, seizures, coma and ketoacidosis as seen in the first week of life. Several different variants have been found with MSUD which differ in severity, age of onset, clinical symptoms and thiamine responsiveness.

Prevalence:	1: 150,000 – 1:290,000
Analyte Measured:	Leucine and isoleucine
Reporting Ranges:	Elevated levels of leucine and isoleucine
Feeding Effect:	None
Timing Effect:	None
Confirmation:	Quantitative measurement of leucine, isoleucine and valine
Treatment:	Referral is made to a Metabolic Specialist. Correct any symptoms of dehydration, electrolyte imbalances and metabolic acidosis. A dietary consult is made for a special MSUD formula low in BCAA and a diet low in protein.
Comment:	MSUD is a chronic long-term disorder where the patient may decompensate when stressed and is at risk of mental and neurological deficits and sudden death. Strict compliance with treatment is necessary to prevent neurological damage. Affected people must stay on this special diet for life.

Medium-chain Acyl Co-A Dehydrogenase Deficiency (MCAD)

MCAD deficiency is the most common fatty acid oxidation disorder. MCAD generally presents clinically between the second month and second year of life, although presentation may occur from 2 days to 6 years. MCAD results in recurrent episodes of hypoglycemia, acidosis, seizures, vomiting and coma when an affected infant is stressed. Early detection, prevention of fasting and monitoring for illness or infection are essential to prevent death in infants with MCAD.

Prevalence: 1:6,000- 1: 15,000 live births

Analyte Measured: Acylcarnitines

Reporting Ranges: Elevated octanoylcarnitine (C8-Cn)

Feeding Effect: None

Timing Effect: Specimens collected within the first 24 hours of life may be elevated.

Other Effect: None

Confirmation: Frequent feedings are important in preventing symptoms in an infant who may have MCAD.

Repeat filter paper specimen, blood and urinary metabolites and confirmation by DNA analysis for A985>G mutation, as directed by program staff or Metabolic Specialist.

Imposed fasting is not recommended as a screening test or confirmation of the disorder.

Treatment: Referral will be made to a Metabolic Specialist. Avoidance of fasting and monitoring of illness or infection. Supplementation with L-carnitine may be indicated. Prompt treatment of illness and possible intravenous glucose therapy may be indicated when unable to maintain oral intake.

Comment:

Affected children are healthy and usually asymptomatic until stressed by fasting, illness or infection. Clinical symptoms include lethargy, vomiting, encephalopathy, respiratory arrest, hepatomegaly, seizures, apnea and cardiac arrest.

Symptoms which are triggered by fasting or infection are fatal in 25% of undiagnosed infants with first event. MCAD may be misdiagnosed as Reye Syndrome and may be responsible for 2-7% of SIDS deaths.

Hemoglobinopathy

Included in newborn screenings, all filter paper specimens are routinely tested for sickle cell disease and other hemoglobinopathies. **Sickle Cell disease** is characterized by the presence of abnormal red blood cells that do not transport oxygen efficiently and may become sickle shaped, causing anemia and pain due to occlusion of the blood vessels. Most commonly found in persons of African ancestry, Sickle cell disease also affects people of Mediterranean, Caribbean, South and Central American, Asian and Middle Eastern descent.

Other defects in globin-chain synthesis yield other hemoglobin variants. Some cause serious health problems such as hemolytic anemia, splenomegaly, sepsis, progressive retinopathy, pulmonary vasoocclusion, hydrops fetalis, stillbirth, and others only a mild anemia. The most common structural variants other than HbS are HbC, HbD and HbE (the most common quantitative variants), are the thalassemias. Geographic origins to be considered include equatorial West and North Africa, India, Pakistan, Afghanistan, Turkey, Iran, Egypt, Southeast Asia, India, Sri Lanka, the Philippines, Greece, Sicily.

As Maine's population grows more diverse and many of these geographic areas are represented, it is important to be aware of children who need screening for various hemoglobinopathies. With any hemoglobinopathy, genetic counseling is recommended primarily for parental education and to assess risk for any significant hemoglobin disease in future children.

Sickle Cell Disease:

Prevalence: 1:15,000
1:400 in African Americans

Analytes Measured: Hemoglobin Fractions
FA, AF, A

Reporting Ranges: Absence of Hemoglobin A

Feeding Effect: None

Timing Effect: None unless transfused

Note: If infant has been transfused, repeat specimen should be obtained at 2 months post transfusion due to potential for transfused blood to mask hemoglobinopathies.

Confirmation: By Isoelectric Focusing and citrate agar electrophoresis.

Treatment: Referral made to the Maine Hemophilia Treatment Center and a Pediatric Hematologist. Prophylactic use of penicillin and treatment of symptoms. Treatment may vary for different hemoglobin defects.

Comments: Affected babies are more likely to have pain, strokes and life-threatening infections. Treatment should begin after diagnosis and by no later than 2 months of age. With screening, penicillin prophylaxis, more aggressive and careful management, early death and complications from stroke and infections have been greatly reduced.

MAINE GENETIC RESOURCES

MAINE GENETICS PROGRAM (MGP)

Department of Health and Human Services
Maine Centers for Disease Control and Prevention
Division of Family Health
11 State House Station,
Augusta, Maine 04333-0011
PHONE (207) 287-5357, or 1-800-698-3624
FAX (207) 287-4743

The Maine Genetics Program (MGP) is a statewide program that provides grants to agencies to assure the availability of comprehensive genetic services for the citizens of Maine. Services include risk assessment, laboratory and clinical diagnosis, counseling, case management and referral, and, education and training to providers and consumers. The MGP also coordinates the Newborn Bloodspot and Newborn Hearing Screening Programs. The Newborn Bloodspot Screening Program screens all newborns for 9 mandatory conditions, plus an additional 19 optional conditions, which if left untreated, would cause mental retardation, other serious health problems or death. The Newborn Hearing Screening Program tests all newborns for possible hearing loss. Both the Newborn Bloodspot Screening Program and the Newborn Hearing Screening Program make referrals for treatment and comprehensive follow-up care.

EASTERN MAINE MEDICAL CENTER GENETICS PROGRAM

Pediatric Specialty Clinics
Webber East Suite 305
417 State Street
Bangor, Maine 04401
PHONE (207) 973-7559 or Toll-free 1-877-366-3662 X7559
(Program Office, Clinic Coordinator)
PHONE (207) 973-7553 or Toll free 1-877-366-3662 X7553
(Program Office, Secretary)

The Genetics Program provides consultation and management services for individuals, couples, and families through a number of specialty clinics provided by the Genetics Program at EMMC. The Program provides initial genetic evaluation, assessment and ongoing management for persons with a known genetic condition. In addition to the Genetics Clinic, the Genetics Program is also responsible for the following:

- Metabolic Clinic - provides assessment, diagnosis, and management of inborn errors of metabolism.
- Evaluation and assessment of persons with specific conditions and their families through a number of specialty clinics including the Spina Bifida Clinic, Cystic Fibrosis Clinic, Cleft Lip and Palate Clinic and Hemophilia Clinic.
- Muscular Dystrophy Clinic - provides evaluation and follows long-term, individuals and families with a wide variety of neuromuscular conditions.

- Provides Medical Genetics consultations and prenatal and preconception counseling for area physicians and women's health programs, including the Maternal Fetal Medicine Program at EMMC.
- Developmental Evaluation Clinics provide consultation services.
- Cancer Risk Counseling Clinic - provides assessment for individuals and families at risk for a variety of hereditary cancer syndromes. Options for testing individuals for cancer susceptibility genes as well as screening and preventative strategies are reviewed. An oncologist is available for consultation.

All clients are seen regardless of ability to pay for services.

In addition to clinical services, the Genetics Program offers educational and training to health professionals and other groups throughout the state.

To make a referral:

For referrals and questions call 973-7559 or 973-7553.

To schedule cancer genetic counseling call 973-7476.

MAINE MEDICAL CENTER , THE DIVISION OF GENETICS AT THE BARBARA BUSH CHILDREN'S HOSPITAL

Maine Pediatric Specialty Group
 887 Congress Street, Suite 320
 Portland, ME 04102
 PHONE (207) 662-5522 or 1-800-860-6277
 FAX (207) 662-5528

The Division of Genetics at the Barbara Bush Children's Hospital provides Genetics services for individuals from primarily southern Maine and New Hampshire. Consultative and management services include dysmorphology evaluations, ongoing management of complex medical care for individuals with known diagnoses, family risk assessment, provision of genetic testing, genetic counseling, evaluation, diagnosis and management of inborn errors of metabolism, enzyme replacement therapy services for lysosomal storage diseases and prenatal consultations in complex cases. The Division of Genetics also provides essential services and education to primary care physicians and other subspecialists at MMC, in the community, as well as throughout the State of Maine and New Hampshire.

The Division is also responsible for the Barbara Bush Children's Hospital Metabolism Program, and provides support for the Southern Maine Cleft Lip and Palate Program, the Cystic Fibrosis Clinic, the Hemophilia Clinic, the Maine Children's Cancer Program and the Spina Bifida Program. Medical Genetics consultations are also provided to the Division of Maternal Fetal Medicine at MMC and the Genetics staff at the Maine Center for Cancer Medicine.

All clients are seen regardless of ability to pay for services.

MAINE MEDICAL CENTER, DIVISION OF THE CANCER GENETICS PROGRAM

Cancer Risk and Prevention Clinic at Maine Medical Center

100 US Route 1

Scarborough, ME 04074

PHONE (207) 885-8533

FAX (207) 885-8500

The Cancer Risk and Prevention Clinic provides a family history evaluation and genetic risk assessment for individuals and families primarily in Southern Maine and New Hampshire. A visit includes a review of an individual's personal and/or family history of cancer in order to evaluate possible hereditary cancer susceptibility disorders (HCSDs). The genetic counselor explains genetics, inheritance, genetic syndrome differentials, available testing, possible testing outcomes, and research possibilities. A visit continues with the physician who reviews an individual's personal history in order to provide a more personalized risk assessment. Furthermore, the doctor is available to answer medical questions, discuss differentials, and make recommendations for follow up surveillance, screening, and potential prevention. Currently available clinic times are Tuesday afternoons from 12:30 – 4:00. Follow up visits may be scheduled on alternate days.

While direct patient care is the main focus, the Cancer Genetics Program also provides essential services and education to primary care physicians and other sub-specialists at MMC, in the community, as well as throughout the State of Maine and New Hampshire. To discuss a case or schedule education services please contact (207) 885-7591.

To make a referral, contact (207) 885-8534.

OTHER RELATED SERVICES WITH A GENETIC COMPONENT:

CHILDREN WITH SPECIAL HEALTH NEEDS PROGRAM, (CSHN)

Department of Health and Human Services

Maine Centers for Disease Control and Prevention

Division of Family Health

11 State House Station, Augusta, Maine 04333

PHONE (207) 287-5139 or 1-800-698-3624. Call to refer a child/family.

Website: <http://www.maine.gov/dhhs/boh/cshn/>

The Children with Special Health Needs Program (CSHN) serves children who have a serious physical condition(s) that requires health and related services beyond those generally required by children.

Chronic physical conditions that are covered by the CSHN Program include, but are not limited to, the following: Asthma and other Respiratory Disorders, Blood Disorders, Cardiac Disorders, Childhood Cancer, Chronic Ear Infections, Cleft Lip and/or Cleft Palate, Other Craniofacial Anomalies, Cystic Fibrosis, Developmental Delays, Diabetes and Other Endocrine Disorders, Gastrointestinal Disorders, Genitourinary Disorders, Juvenile Arthritis, Orthopedic Disorders, PKU and Other Inborn Errors of Metabolism, Seizure Disorders, Skin Disorders, Spina Bifida, Vision Disorders.

The Program pays for diagnosis and special medical care provided by medical specialists for those children who meet the medical and income guidelines.

In addition, the Program supports and/or administers the following clinics:

Developmental Evaluation Clinics are available at Cary Medical Center, Eastern Maine Medical Center, MaineGeneral Medical Center in Waterville, and The Child Health Center in Auburn. The clinic teams are composed of health professionals with a special interest and expertise in the field of child development.

Maine Cleft Lip and Palate Clinic is supported and administered by CSHN Program in two regional sites, Bangor and Portland. Members of the Cleft Palate Clinic team include a variety of physician specialists, medical social worker, nurses and others. The Maine Cleft Palate Clinic offers home visits to families of newborns with cleft lip/palate to provide information and resources available to families. Feeding issues and nutritional status are assessed and appropriate referrals are made to assist the family.

MAINE PEDIATRIC SPECIALTY GROUP – ENDOCRINOLOGISTS:

Maine Pediatric Specialty Group
887 Congress Street, Suite 320
Portland, ME 04102
PHONE (207) 662-5522 or 1-800-860-6277
FAX (207) 662-5528

Pediatric endocrinologists in private practice offering ongoing care of children with inherited endocrine disorders, such as Congenital Hypothyroidism and Congenital Adrenal Hyperplasia.

MAINE MEDICAL CENTER, DIVISION OF THE BARBARA BUSH CHILDREN'S HOSPITAL, MAINE HEMOPHILIA TREATMENT CENTER:

Maine Children's Cancer Program
100 U.S. Route One
Scarborough, ME 04074
PHONE (207) 885-7565
FAX (207) 885-7577

Maine Medical Center provides comprehensive clinical services to individuals with Hemophilia and other coagulation disorders. Genetic counseling services and coordination of DNA analysis for carrier testing and prenatal diagnosis are arranged when indicated.

THE FOUNDATION FOR BLOOD RESEARCH

DIVISION OF GENETICS

8 Nonesuch Road

Scarborough, Maine 04074

PHONE (207) 883-4131

FAX (207) 883-1385

The Division of Genetics at the Foundation for Blood Research (FBR) focuses on the integration of genetics into public health and private healthcare systems in Maine. It addresses this pressing need through several activities. Immediately available to primary and allied healthcare personnel are CME/CEU lectures and presentations offered either in person or via interactive TV (telemedicine), as well as publications (see listing at www.fbr.org/genetics).

Maine Newborn Bloodspot Screening Program – Statutory Authority

In 1965, the Maine State Legislature enacted a law mandating the testing of all infants born in the State of Maine for “the detection of causes of mental retardation.” (See 22 MRSA, Chapter 261-A, Section § 1532, page 48.)

In addition, Section § 1533 required establishment of an advisory program for genetic conditions. The purpose of this program was “to offer testing, counseling and education to parents and prospective parents.” To achieve this, the Maine Genetics Program was developed and continues to collaborate with individuals specializing in the fields of genetic, metabolic, endocrine and other inherited disorders. The Program is responsible for coordinating comprehensive genetic services to all areas of Maine and all segments of the population. This involves monitoring compliance with specimen collection and testing in accordance with the law. The Program is also responsible for administration of funds to be appropriated for genetic screening, counseling and education. The Maine Genetics Program was further established to coordinate with other public health and not-for-profit agencies to develop, design and implement treatment services, research, and education for health care providers and the public.

Rules and regulations were written that outline the responsibilities of hospitals, laboratories, administrators, health care providers and the Maine Newborn Bloodspot Screening Program regarding specimen collection, testing, reporting, and follow up treatment.

The rules require birth facilities to designate a contact person to oversee compliance with policy and procedures relating to specimen collection. For infants who are not born in a Maine birth facility, the rules define responsibilities for birth attendants.

Specific instructions on the timing of blood specimen collection, documentation, and result notification, as mentioned at the beginning of this manual, are outlined in the rules. Specimen storage is also outlined. Parents are allowed to refuse testing based on religious objections only. The rules state that healthcare providers and birth facilities shall notify the Maine Newborn Bloodspot Screening Program of any refusal within the infant’s first two weeks of life.

Since science and technology is emerging rapidly, the rules allow the Maine Department of Health and Human Services, as requested by Public Health, to consider the addition of testing for new disorders as advances become available. Recommendations are considered as advised by the medical community and the public. The Maine Genetics Program, with its Joint Advisory Committee, thoroughly reviews, researches and considers all aspects of additional testing.

Maine State Law- Relating to Newborn Screening

**Title 22 Maine Revised Statutes Annotated: HEALTH AND WELFARE
CHAPTER 261-A
PREVENTION OF HANDICAPPING CONDITIONS**

Section § 1532. Detection of mental retardation

The department may require hospitals, maternity homes and other maternity services to test newborn infants, or to cause them to be tested, for the presence of metabolic abnormalities which may be expected to result in subsequent mental deficiencies. The department shall promulgate rules to define this requirement and the approved testing methods, materials, procedure and testing sequences. Reports and records of those making these tests may be required to be submitted to the department in accordance with departmental rules. The department may, on request, offer consultation, training and evaluation services to those testing facilities. The provisions of this section shall not apply if the parents of a child object to them on the grounds that the test conflicts with their religious tenets and practices.

1983, c. 848, § 2.

Historical and Statutory Notes

Derivation:

1965, c. 224.

Laws 1983, c. 848, § 1.

Former § 1522 of this title.

STATE OF MAINE LAWS

Maine Rules and Regulations for Newborn Screening

MAINE DEPARTMENT OF HEALTH AND HUMAN SERVICES MAINE CENTER FOR DISEASE CONTROL & PREVENTION DIVISION OF FAMILY HEALTH NEWBORN SCREENING PROGRAM

CHAPTER 283

RULES AND REGULATIONS RELATING TO TESTING NEWBORN INFANTS FOR DETECTION OF CAUSES OF MENTAL RETARDATION AND SELECTED GENETIC CONDITIONS

SUMMARY: These rules and regulations define the responsibilities of hospital administration and staff, physicians and other health care providers, midwives and other “principal birthing attendants”, parents and others, with regard to the screening of newborn infants for inborn errors of metabolism and other selected genetic conditions. These rules and regulations address the designation of a contact person in each hospital, timing of newborn blood specimen collection, parental refusal of tests, conditions to be screened, types of records to be maintained, responsibilities for follow-up tests and reporting when necessary, and the storage and use of leftover specimens.

1.0 PURPOSE

These rules and regulations implement section 1532 of Title 22 of the Maine Revised Statutes Annotated, governing the testing of newborn infants for the detection of causes of mental retardation and section 1533 of Title 22 of the Maine Revised Statutes Annotated, establishing a statewide genetics program. Unless the infant’s parent(s) objects on religious grounds, the responsible hospital, birthing center, physician, midwife, principal birthing attendant, or health care provider shall cause to be taken blood specimens from each infant either born in the State of Maine or moving to Maine within three months of birth (see Section 5.1 for infants not born in Maine). The blood specimens shall be obtained by heel stick and collected on filter paper forms available from the Maine Health and Environmental Testing Laboratory (HETL), Maine Department of Health and Human Services, and shall be dried and forwarded to the screening laboratory designated by the Department in the envelopes provided with the forms within 1 working day after collection.

2.0 DEFINITIONS

- 2.1 “Birthing center” means any non-hospital health facility, institution, or place designed to accommodate mothers giving birth away from home at the culmination of normal, uncomplicated pregnancies.
- 2.2 “Principal birthing attendant” means any adult who acts as the principal attendant during a delivery that occurs at a site other than a hospital or birthing center. This may be a midwife or other adult attendant.

- 2.3 “Designated screening laboratory” means the laboratory with which the state contracts to process the screening specimens and to provide the screening results to the Maine Newborn Screening Program.
- 2.4 “Department” refers to the Maine Department of Health and Human Services (previously known as Department of Human Services), including the Maine Center for Disease Control & Prevention (previously known as the Bureau of Health).
- 2.5 “Health care Provider” means a physician, advanced practice nurse or other licensed professional acting as primary health care provider for the infant.

3.0 RESPONSIBILITY FOR SPECIMEN COLLECTION FROM INFANTS BORN IN HOSPITALS OR BIRTHING CENTERS IN MAINE.

- 3.1 The administrator of the hospital/birthing center shall be responsible for assuring that a blood specimen is collected from each newborn infant prior to his/her discharge from the facility (see Section 7 for timing of the specimen collection).
- 3.2 Each administrator of a hospital or birthing center involved in such testing shall appoint, and provide to the Maine Newborn Screening Program, Division of Family Health, Maine Department of Health and Human Services, the name of a contact person at the facility, who shall be responsible for coordinating the facility’s screening activities.
- 3.3 The person who actually draws the blood specimen by performing a heel stick shall fully and clearly complete the filter paper form, and record in the infant’s chart the fact that the blood specimen was collected, including date and time when collected.
- 3.4 No infant shall be discharged until his/her chart is checked to assure that a blood specimen for newborn screening has been collected. The facility employee who assembles the discharge papers before the infant leaves the facility shall check that a blood specimen has been collected and that this fact has been recorded in the infant’s medical record. The fact that the infant has had a specimen collected shall be included in any discharge instructions that are given to the parent(s).
- 3.5 The Maine Newborn Screening Program will send, to the hospital contact person (see Section 3.2 above) test results for infants whose blood specimens are received for testing. The contact person shall compare these results to the hospital’s list of infants discharged to assure that each infant was tested before discharge, and that each blood specimen was received for testing. If any infant is identified as having been discharged without testing, or without a blood specimen having been received for testing, the contact person shall notify the infant’s physician or other health care provider (within 24 hours) and the Maine Newborn Screening Program (within 5 working days) of discovering

that fact. The health care provider shall then take appropriate steps to have the infant tested within 5 working days.

- 3.6 If an infant is transferred to a second facility during the first 48 hours of life, the blood specimen shall be taken at the second facility. The first facility shall clearly indicate in the papers accompanying the infant that the child needs to be screened (see also Section 7.0) and notify the Maine Newborn Screening Program of the transfer within 5 working days.
- 3.7 The administrator of the hospital or birthing center shall ensure that each blood specimen is forwarded to the designated screening laboratory within 1 working day after collection.
- 3.8 All screening results will be returned by the Maine Newborn Screening Program to the hospital contact person (Section 3.2 above), by providing individual result reports. The screening results will be recorded in the individual infants medical record.
- 3.9 The administrator of the hospital or birthing center shall ensure that at least 10% of infants' medical records are reviewed within 8 weeks after discharge, to assure that screening information, including result, has been recorded.
- 3.10 The administrator of the hospital or birthing center shall ensure that all employees are informed of their responsibilities with respect to these regulations.

4.0 RESPONSIBILITY FOR SPECIMEN COLLECTION FROM INFANTS BORN IN MAINE BUT NOT IN A HOSPITAL OR BIRTHING CENTER.

- 4.1 If an infant is delivered outside a hospital or birthing center, midwife or the principal birthing attendant who is authorized to draw blood, shall ensure that a blood specimen is collected by performing a heel stick at the appropriate time (Section 7.0), dried and that the filter paper form is fully completed and forwarded to the designated screening laboratory within 1 working day after collection of the specimen.
- 4.2 This midwife or principal birthing attendant shall record in the infant's record the fact that the blood specimen was collected, including date and time of collection, and that the filter paper form was completed and forwarded to the designated screening laboratory.
- 4.3 If the midwife or principal birthing attendant is not authorized to draw blood, he or she shall:
 - a. inform the parent(s) about the screening tests and the State law governing them;
 - b. direct the parent(s) to see an individual authorized to draw blood and have the infant tested by the 3rd day of life;
 - c. contact the parent(s) by the 5th day of life to verify that the infant has been tested; and

- d. keep a written record of each of the actions required under this rule.

5.0 RESPONSIBILITY FOR SPECIMEN COLLECTION FROM INFANTS NOT BORN IN MAINE

- 5.1 If an infant is not born in the State of Maine but is, or subsequently becomes, a resident of Maine, the first primary health care provider in Maine who examines the infant in the first 3 months of life should verify whether the infant has been screened, and if not, shall perform the test. The health care provider may rely upon the information in the infant's medical record to determine whether such screening has been done.

6.0 RESPONSIBILITY OF THOSE PROVIDING PEDIATRIC SERVICES

- 6.1 The primary health care provider in Maine who examines an infant for the first time in the first three months of life should determine whether the child has been screened for causes of mental retardation and selected genetic conditions by checking the infant's medical records, asking the parent(s) or, if necessary, contacting the Maine Newborn Screening Program. If the health care provider determines that no screening has been performed, he/she shall, within 5 working days, screen the infant by collecting a blood specimen as outlined in Section 1.0.

- 6.2 Any physician or other health care provider subject to these rules who has identified a **(potential)** case of a child presenting with a genetic condition or metabolic disorder listed in the Department's Newborn Screening Program shall notify the Newborn Screening Program of such condition within five business days of the identification.

7.0 TIMING OF BLOOD SPECIMEN COLLECTION

- 7.1 For term infants, the specimen shall be taken by the 3rd day of life or, if the infant's stay in the hospital or birthing center is less than 3 days, as close to discharge as possible.
- 7.2 For infants who are discharged within 24 hours of birth, a first blood specimen shall be taken as close to discharge from the hospital or birthing center as possible, and a second specimen shall be taken as close to the 3rd day as possible and not later than the 7th day. The administrator of the hospital or birthing center shall assure:
 - a. that the infant's parents are notified of what they need to do to complete the second test;
 - b. that the infants' primary health care provider is notified of the early discharge and of need for the second test; and
 - c. that such notifications are made a part of the infants' medical records.
- 7.3 For preterm, sick or other infants in intensive care, specimens shall be taken on the day of discharge from the hospital or birthing center or, if the stay at the facility is prolonged beyond 3 days, on the 3rd day of life, regardless of feeding

status with a second specimen taken at 2 weeks or at discharge from intensive care, whichever is earlier, unless otherwise indicated.

- 7.4 For infants receiving blood transfusions, obtain specimen, if possible, before any anticipated transfusion, regardless of infant's age. Obtain a second specimen 3 to 7 days post-transfusion.

8.0 SCREENING TEST PERFORMED

- 8.1 The Department will consider changes in conditions to be screened as requested by the Maine Center for Disease Control & Prevention, the medical community or the public. The Department shall consult with medical providers and the program advisory committee in making these decisions.
- 8.2 The Department shall determine conditions to be screened considering:
- The condition has significant mortality and morbidity when not diagnosed before symptoms appear.
 - The condition may not be identified early clinically.
 - The prevalence of the condition in the population is significant.
 - Presymptomatic treatment affects outcome.
 - A simple, inexpensive and effective screening method is available.
 - Resources for treatment and counseling are available.
 - The costs of screening, diagnosis and treatment can be justified by increases in well-being and quality of life for affected individuals and their families.
- 8.3 As of the effective date of these regulations, all newborn blood specimens are tested for the following disorders:

Biotinidase Deficiency

Galactosemia

Endocrine Disorders:

Congenital Adrenal Hyperplasia (CAH)

Congenital Hypothyroidism

Hemoglobinopathies

Amino Acid Disorders:

PKU (Phenylketonuria)

MSUD (Maple Syrup Urine Disease)

HCU (Homocystinuria)

Tyr I (Tyrosinemia I)

Tyr II (Tyrosinemia II)

Urea Cycle Disorders:

ASS (Citrullinemia)

ASL (Argininosuccinic Aciduria)

Argininemia

HHH Syndrome Hyperammonemia Hyperornithinemia Homocitrullinemia

Fatty Acid Oxidation Disorders:

MCAD (Medium-Chain Acyl Co-A Dehydrogenase Deficiency)

LCAD (long-chain acyl-CoA dehydrogenase deficiency)

LCHAD (long-chain hydroxy-CoA dehydrogenase deficiency)
VLCAD (very long-chain acyl-CoA dehydrogenase deficiency)
SCAD (short chain acyl-CoA dehydrogenase deficiency)
CPT II Carnitine Palmitoyl Transferase deficiency Type II (CPT Deficiency)
GA II (Glutaric Acidemia II)
Organic Acid Disorders:
GA I (Glutaric Acidemia I)
IVA (Isovaleric Acidemia)
MMA (Methylmalonic Aciduria)
PPA (Propionic Acidemia)
HMG (HMG CoA Lyase Deficiency)
MCC (B-Methyl Crotonyl Carboxylase)
B-KT (B-Ketothiolase Deficiency)

9.0 PARENTAL REFUSAL OF THE SCREENING TESTS

- 9.1** In the instance of parental refusal of the screening tests on religious grounds, the parental refusal shall be stated in writing and made a part of the infant's medical record.
- 9.2** The administrator of hospitals and birthing centers, and principal birthing attendants shall ensure that the Maine Newborn Screening Program, Maine Department of Health and Human Services is notified in writing of the parental refusal within 14 days of the infant's birth.

10.0 FOLLOW-UP TESTS

- 10.1** The Maine Newborn Screening Program shall forward any follow-up test requests to the appropriate health care provider within 2 working days of being notified, by the designated screening laboratory, of the need for follow-up testing. A filter paper form shall be supplied with the follow-up request, unless otherwise indicated.
- 10.2** The health care provider shall submit a follow-up test specimen, using the supplied filter paper form, within 10 working days of the date of the request, or as otherwise indicated in the request.
- 10.3** If the health care provider cannot submit a follow-up test specimen within 10 working days, he/she shall notify the Maine Newborn Screening Program of this fact and the reason for it.
- 10.4** If the health care provider processes a requested repeat specimen through a local laboratory, he/she will notify the Maine Newborn Screening Program of the results.
- 10.5** Test results for repeat or follow-up screening tests will be reported directly to the appropriate health care provider by providing result reports.

- 10.6** For the purpose of coordinating efforts to detect, prevent, and treat genetic conditions and metabolic disorders, the Department may share individually identifiable health information related to the potential presence of genetic conditions and metabolic disorders, listed in the Department's Newborn Screening Program with other public health programs and agencies whose mission is to detect, prevent and treat these disorders.

11.0 ADVISORY COMMITTEE

- 11.1** The Department shall appoint an advisory committee to advise the program on issues related to the screening and follow-up of newborns.

12.0 FILTER PAPER STORAGE AND USE

- 12.1** The primary use of filter paper specimens is for the processing of newborn screening tests as allowed by these rules.
- 12.2** After testing is completed, leftover filter paper specimens will be stored indefinitely. This policy shall be reviewed by the Advisory Committee, every five years and recommendations made to the Department. Storage conditions shall be appropriate, secure and stable and allow specimens to be retrieved if necessary.
- 12.3** Leftover filter paper specimens may be used for further testing as indicated/requested by the submitting or attending health care provider if these tests are available through contracted laboratory or through other laboratories with consent of the family.
- 12.4** The information collected in this program is maintained by the Department. Information is used to identify infants at risk of birth defects in order to develop programs to prevent and detect such defects.
- 12.5** Unless the person or his/her legal authorized representative specifically prohibits such use in writing, the blood specimen and information obtained during the testing process becomes the property of the State and may be used for program evaluation or research by the Department or Department-approved scientific researchers to improve the health of mothers and children. Such studies are published without identifying the person or persons from whom these results were obtained.
- 12.6** Filter paper specimens may be released for research or testing with identifiers intact with specific written request or consent of a parent/guardian; for anonymous research without consent as approved by the Department with input from the program advisory committee; or for program evaluation or planning without consent.

13.0 PENALTIES

- 13.1 Failure to comply with these regulations may result in the imposition of such civil and criminal penalties as are specified under 22 M.R.S.A., Section 47.

BASIS STATEMENT: These rules were adopted to define responsibilities to assure that all infants born in Maine are screened for causes of mental retardation and selected genetic conditions (unless the infant's parent(s) object on religious grounds) in time to allow for treatment to prevent retardation and other health problems.

Revised 2006



John Elias Baldacci
Governor

Maine Department of Health and Human Services

Maine Center for Disease Control and Prevention
(Maine CDC)
286 Water Street
11 State House Station
Augusta, ME 04333-0011

Brenda M. Harvey
Commissioner

Dora Anne Mills, MD, MPH
Public Health Director
Maine CDC Director

MAINE NEWBORN SCREENING PROGRAM TEST REFUSAL

INFANT'S NAME: _____

DATE OF BIRTH: _____ PLACE OF BIRTH: _____

PARENT (S)/GUARDIAN (S) NAME: _____

ADDRESS: _____

I/We understand that **Maine law** requires all infants to be tested for 28 conditions that can cause mental retardation and other health problems. Included in this testing are phenylketonuria, hypothyroidism, galactosemia, homocystinuria, MCAD, and maple syrup urine disease. These conditions are easily detected and can be treated to prevent **mental retardation and other health problems, which may include problems with growth, eye problems, blood clots, coma or death.**

I/We understand that all infants must be tested except when a parent has a religious objection to the testing. This objection relates to religious beliefs and is not an alternative to testing prior to early discharge.

I/We refuse to have my baby tested because my religious beliefs do not allow it. I have read this information and understand the possible consequences of this decision. I also understand that the **MAINE NEWBORN SCREENING PROGRAM** will be notified of this refusal, as is required by **Maine law**.

SIGNATURE: _____ RELATIONSHIP: _____ DATE: _____

SIGNATURE: _____ RELATIONSHIP: _____ DATE: _____

(second parent/guardian optional)

WITNESS: _____ DATE: _____

MEDICAL PERSONNEL

I have explained the **Maine law** requiring the newborn screening test, how the tests are done, the meaning of the results, and the possible consequences to this infant of not performing these tests, and have answered any questions the above adults had about the tests. This refusal relates to religious objections and is not an alternative to testing prior to early discharge.

NAME: _____

TITLE: _____ DATE: _____

SIGNATURE: _____

NAME OF CHILD'S DOCTOR: _____

ADDRESS: _____

Our vision is Maine people living safe, healthy and productive lives.
www.mainepublichealth.gov



John Elias Baldacci
Governor

Maine Department of Health and Human Services

Maine Center for Disease Control and Prevention
(Maine CDC)
286 Water Street
11 State House Station
Augusta, ME 04333-0011

Brenda M. Harvey
Commissioner

Dora Anne Mills, MD, MPH
Public Health Director
Maine CDC Director

In accordance with Chapter 283, Section 3.6, of the Rules and Regulations Relating to the Testing of Newborn Infants for Detection of Causes of Mental Retardation and Selected Genetic Conditions, "if an infant is transferred to a second facility during the first 48 hours of life, the blood specimen shall be taken at the second facility. The first facility shall clearly indicate in the papers accompanying the infant that the child needs to be screened and notify the Maine Newborn Bloodspot Screening Program of the transfer within 5 working days."

NOTIFICATION OF HOSPITAL TRANSFER

Transferring Facility: _____

Name of Infant: _____ DOB: _____

Mother's Name: _____

Infant's Primary Care Provider: _____

Date of Transfer: _____

Hospital Transferred To: _____

Newborn Screening Sample Obtained Prior to Transfer? YES _____ NO _____

Please Note Any Suspected Birth Defects: _____

Name of Personnel Completing Form: _____

Please mail or fax completed form to the Maine Newborn Bloodspot Screening Program at 207-287-4743

Our vision is Maine people living safe, healthy and productive lives.
www.mainepublichealth.gov

Quality Assurance and Assessment Tool

The Maine Newborn Bloodspot Screening Program has developed this Quality Assurance tool for hospitals to use as a guideline to assure that each specimen is collected correctly and in a timely manner.

One of the challenges facing the Maine Newborn Bloodspot Screening Program (MNBSPP) is an unsatisfactory specimen usually related to improper technique. An unsatisfactory specimen can compromise the accuracy of the result or delay the rapid reporting and follow-up care of a baby newly diagnosed with a metabolic or endocrine disorder.

DELAYED OR MISSED SAMPLE

- ❖ Has the sample been collected after the baby is at 24 hours of age?
- ❖ Was a sample collected before discharge?
- ❖ Does the medical record have documentation that the Newborn Screening specimen was collected?

STORAGE

- ❖ Are filter papers kept in a clean dry place, in a vertical position?
- ❖ Are enough filter papers on hand?
- ❖ Is the supply monitored to assure that the availability of forms is within the expiration date?

EDUCATION

- ❖ Is newborn screening education started during the perinatal period?
- ❖ Has the mother been informed of the testing available?
- ❖ Has the mother received the Maine Newborn Bloodspot Screening Booklet?
- ❖ Have all the questions and concerns been answered by the health care provider, nurse, etc.?
- ❖ How has the parent received information on the newborn bloodspot screening?
- ❖ Does the staff know which disorders are a part of the screening or where to find this information?

DOCUMENTATIONS

- ❖ Is there a log in the nursery or lab documenting each newborn's date and time of birth and blood collection?
- ❖ Does your facility use the log to track the specimens until the results are received?
- ❖ Does your facility keep the carbon copy of the filter paper form, and is it viewed for completeness and legibility?
- ❖ Is there someone at your facility to track unsatisfactory specimens?
- ❖ Does your facility have a system set up to guarantee that ALL newborns are screened prior to discharge?
- ❖ Has the filter paper been filled out accurately and completely? This includes complete name and address of mother, healthcare provider, baby's name, date and time of birth and specimen collection.
- ❖ Is there a designated staff person responsible for completion of the filter paper forms?
- ❖ Is there documentation of the person performing the specimen collection?

- ❖ If the parents are refusing the Newborn Screening, has the healthcare provider completed a Maine Newborn Bloodspot Screening Program Refusal Form and obtained the parents' signatures?
- ❖ Is the refusal on the grounds of strict religious objections and so documented as such in the medical record?
- ❖ Does the medical record indicate that the specimen was taken before or after the baby was 24 hours old? If less than 24 hours old, a repeat specimen will be due between 3-7 days of life.
- ❖ Is there an assigned contact person to track unsatisfactory specimens, repeat specimens due to collecting before 24 hours of age, as well as education?
- ❖ Is the staff in-serviced in techniques, documentation and education of parents?

TECHNIQUE

- ❖ Are all staff trained in proper collection and documentation procedures as outlined in the MNBSP manual?
- ❖ Are the staff able to describe a satisfactory and an unsatisfactory specimen?
- ❖ Does your facility track unsatisfactory specimens back to the individual who collected it and retrain as necessary?
- ❖ Are all specimen collection procedures followed?

MAILING

- ❖ Are specimens dried for at least 3 hours, away from heat and sunlight on a horizontal, level, non-absorbent surface, such as drying racks, prior to mailing?
- ❖ Are specimens mailed within 24 hours of collection?
- ❖ Are steps taken to avoid subjecting the specimens to heat and humidity prior to mailing?
- ❖ Has your facility assigned someone to review each newborn screen prior to submitting to the lab to make sure the form is complete, legible and the specimen appears satisfactory?
- ❖ Are there enough mailing labels and envelopes available for UPS shipment?

SUMMARY OF DISORDERS

DISORDER	SUBSTANCE TESTED FOR	PREVALENCE	SYMPTOMS OF UNTREATED DISEASE	COMMON INTERVENTIONS & TREATMENT
Congenital Hypothyroidism	Thyroid Hormones: T4 with TSH Confirmation	1:3,000	Mental retardation, growth delay, low metabolic rate, other brain damage	Thyroid hormone
Congenital Adrenal Hyperplasia (CAH)	17-OH Progesterone	1:12,000 (1:300 in Yupik Eskimos)	Addisonian Crisis in all infants; salt wasting in 2/3: dehydration, shock, hyperkalemia, death; virilization of females	Glucocorticoid and/or mineralocorticoid (Florinef)
Hyperphenylalaninemia Including phenylketonuria (PKU)	Phenylalanine	1:11,000	Profound mental retardation, seizures	Low phenylalanine diet Low protein diet
Biotinidase Deficiency	Biotinidase	1:60,000	Mental retardation, seizures, skin rash, alopecia, hearing & vision loss, death	Biotin
Galactosemia	Galactosemia enzyme (GALT)	1:60,000	Severe brain damage, liver disease, cataracts, death	Galactose restricted diet

SUMMARY OF DISORDERS

DISORDER	SUBSTANCE TESTED FOR	PREVALENCE	SYMPTOMS OF UNTREATED DISEASE	COMMON INTERVENTIONS & TREATMENT
Homocystinuria	Methionine	1:200,000	Thromboembolism, ectopic lentis, osteoporosis, seizures, mental retardation	Vitamin B-6, diet low in methionine and protein
Maple Syrup Urine Disease (MSUD)	Leucine	1:150,000	Neonatal coma, convulsions, mental retardation, acidosis, death	Diet low in branched chain amino acids and protein
Medium-chain Acyl Co-A Dehydrogenase Deficiency (MCAD)	Acylcarnitines	1:6,000 to 1:10,000	Varying symptoms may include hypoglycemia, seizures, hepatomegaly, hyperammonemia, cerebral edema and brain herniation, death	Dietary therapy and medications; avoidance of fasting
Hemoglobinopathies (including Sickle Cell Anemia)	Hemoglobin patterns	1:15,000 (1:400 in African Americans)	Death by sepsis or splenic sequestration in sickle cell disease, pneumonia, anemia, sickling crises	Penicillin, Pneumovax, comprehensive care

Quick Summary of Screened Disorders - by Classification

Fatty Acid Oxidation Disorders

Fatty Acid Oxidation Disorders result from an absence of certain enzymes required for the body to convert fat into energy. When an infant or child becomes ill or experiences long periods of fasting, hypoglycemia can precipitate a metabolic crisis. Such a crisis can lead to seizures, respiratory or cardiac arrest and death and/or result in serious brain damage. Early identification of infants with a Fatty Acid Oxidation Disorder may help prevent such a crisis by providing a diagnosis before the baby becomes ill. Treatment consists of avoiding fasting episodes, providing a special low-fat diet, carnitine or other supplements, and prompt notification to a healthcare provider if an infant becomes ill.

All infants born in Maine are screened for the following Fatty Acid Oxidation Disorders:

- ❖ MCAD – Medium-Chain Acyl CoA Dehydrogenase Deficiency
- ❖ LCAD – Long-Chain Acyl CoA Dehydrogenase Deficiency
- ❖ LCHAD – Long-Chain Hydroxy-CoA Dehydrogenase Deficiency
- ❖ VLCAD – Very-Long Chain Acyl CoA Dehydrogenase Deficiency
- ❖ SCAD – Short-Chain Acyl CoA Dehydrogenase Deficiency
- ❖ CPT II – Carnitine Palmitoyltransferase Deficiency
- ❖ GA II – Glutaric Acidemia Type II

Organic Acid Disorders

Organic Acid Disorders result from an absence of, or defect in, certain enzymes necessary to break down amino acids, the building blocks of protein. The result is toxic accumulation of organic acids. Early identification and treatment with a low-protein diet, medications or supplements, can prevent acute episodes resulting in seizures, brain damage, coma and death.

All infants born in Maine are screened for the following Organic Acid Disorders:

- ❖ GA I – Glutaric Acidemia Type I
- ❖ IVA – Isovaleric Acidemia
- ❖ MMA – Methylmalonic Acidemia
- ❖ PPA – Propionic Acidemia
- ❖ HMG – HMG CoA Lyase Deficiency
- ❖ MCC – B-Methyl Crotonyl Carboxylase Deficiency
- ❖ B-KT – B-Ketothiolase Deficiency

Amino Acid Disorders

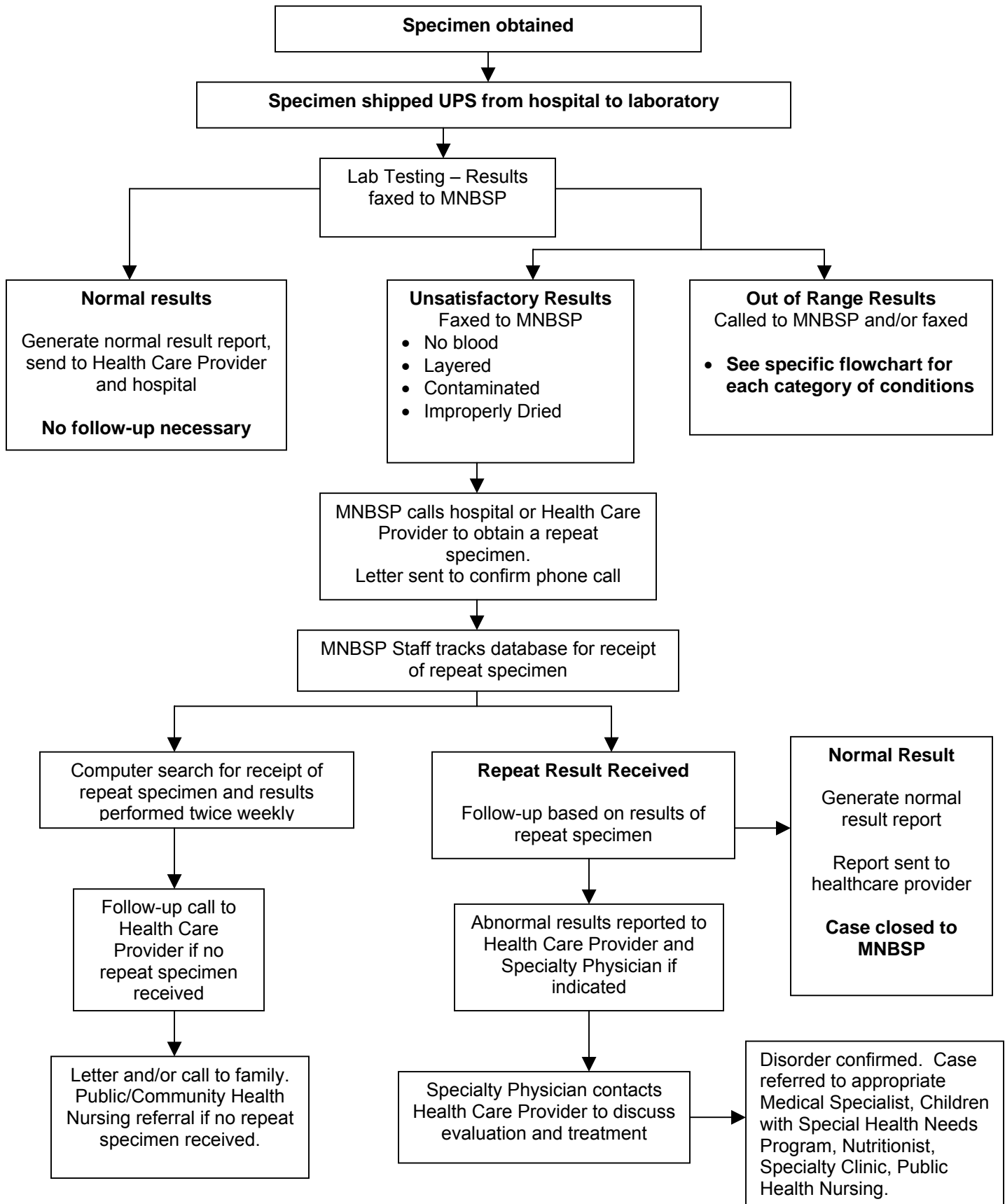
Amino Acid Disorders result from an inherited defect in, or absence of, an enzyme necessary to break down a particular amino acid(s), thus leading to a toxic accumulation of amino acids or ammonia. Untreated, infants can suffer liver failure, skin, eye, growth and development problems, seizures, brain damage, severe mental retardation, liver failure, coma or death. Treatment consists of a low-protein diet, medications or supplements.

All infants born in Maine are screened for the following Amino Acid Disorders:

- ❖ PKU – Phenylketonuria
- ❖ MSUD – Maple Syrup Urine Disease
- ❖ HCU – Homocystinuria
- ❖ Tyrosinemia Type I
- ❖ Tyrosinemia Type II
- ❖ ASS – Citrullinemia
- ❖ ASL – Argininosuccinic Aciduria
- ❖ Argininemia
- ❖ HHH – Hyperammonemia Hyperornithinemia Homocitrullinemia



FLOW CHART OF NEWBORN SCREENING PROCESS



GLOSSARY

Abnormal Result – An out of range screening result of a particular analyte indicating the need for follow-up testing.

Birthing Center – Any non-hospital health facility, institution or place designed to accommodate mothers giving birth away from home at the culmination of normal, uncomplicated pregnancies (Chapter 283 Rules and Regulations Section 2.1).

Designated Screening Laboratory – The laboratory with which the state contracts to process the screening specimens and to provide the screening results to the Maine Newborn Bloodspot Screening Program (Chapter 283 Rules and Regulations Section 2.3).

Diagnosis – Confirmation that a congenital or genetic disorder exists after evaluation of laboratory data and clinical presentation.

Early Specimen – Initial specimen collected prior to 24 hours of life.

MNBSP – Maine Newborn Bloodspot Screening Program

Principle Birthing Attendant – Any adult who acts as the principal attendant during a delivery that occurs at a site other than a hospital or birthing center (Chapter 283 Rules and Regulations Section 2.2).

Sample – A small portion of collected blood on filter paper, which is punched out for processing.

Satisfactory Result – Screening results indicating normal ranges of analytes tested for targeted congenital and genetic disorders.

Satisfactory Specimen – A specimen of adequate quality for testing.

Screening – A means of testing to identify those at risk for a possible genetic disorder and/or congenital condition.

Specimen – A small amount of blood collected on filter paper for use in newborn screening.

Unsatisfactory Specimen – A specimen of poor quality and unreliable for accurate testing.

WEB SITES OF SPECIAL INTEREST

American Academy of Pediatrics. www.aap.org

American College of Medical Genetics (ACMG), 9650 Rockville Pike, Bethesda, MD 20814. Telephone: 301-634-7127. www.acmg.net

American Society for Human Genetics. www.ashg.org

Citizens for Quality Sickle Cell Care, Inc. (CQSCC), 100 Arch Street, P.O. Box 702, New Britain, CT 06050. Telephone: 860-223-7222. <http://cqsc.netfirms.com>

Genetic Alliance, 4301 Connecticut Avenue, Suite 404, Washington, DC 20008. Telephone: 800-336-4363. www.geneticalliance.org

Gene Tests – Gene Clinics (Sponsored by an NIH grant). www.genetests.org

Information for Genetic Professionals. www.kumc.edu/gec/geneinfo.html

Maine Department of Health and Human Services, Public Health, Children with Special Health Needs Program (CSHN). <http://www.maine.gov/dhhs/boh/cshn/home>

March of Dimes, 1275 Mamaroneck Avenue, White Plains, NY 10605. Telephone: 888-663-4637. www.modimes.org

National Coalition of Health Professional Education in Genetics (NCHPEG), 2360 West Joppa Road, Suite 320, Lutherville, MD 21903. Telephone: 410-583-0520. www.nchpeg.org

National Healthy Mothers, Healthy Babies Coalition, 121 North Washington Street, Suite 300, Alexandria, VA 22314. Telephone: 703-836-6110. www.hmhb.org

National Human Genome Research Institute. www.genome.gov

National Institutes of Health. www.nih.gov

National Newborn Screening and Genetics Resource Center is a cooperative agreement between the Maternal & Child Health Bureau, Genetic Services Branch and the University of Texas Health Science Center at San Antonio, Department of Pediatrics, 1912 W. Anderson Lane, Suite 210, Austin, TX 78757, Telephone: 512-454-6419. www.genes-r-us.uthscsa.edu

National Organization for Rare Disorders (NORD) 55 Kenosia Avenue, P.O. Box 1968, Danbury, CT 06813. Telephone: 800-999-6673. www.rarediseases.org

National Society of Genetic Counselors (NSGC), 233 Canterbury Drive, Wallingford, PA 19086. Telephone: 610-872-7608. www.nsgc.org

New England Consortium of Metabolic Programs at Children's Hospital, Boston. www.childrenshospital.org/newenglandconsortium

NERGG, Inc. - New England Regional Genetics Group (NERGG). www.nergg.org

Sickle Cell Disease Association of America (SCDAA). <http://www.sicklecelldisease.org>

The Comprehensive Sickle Cell Centers. <http://www.rhofed.com/sickle>

The Sickle Cell Information Center. <http://www.emory.edu/PEDS/SICKLE>

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- Fearing, MK, and Marsden D. "Expanded Newborn Screening." *Pediatr. Ann* 32.8 (August 2003): 509-15.
- March of Dimes, <http://www.marchofdimes.com/professionals>
- Merck Manual, <http://merck.com/>
- National Newborn Screening and Genetics Resource Center, (NNSGRC). MCHB, Genetic Disease Service and the University of Texas <http://genes-r-us.uthscsa.edu/>
- National Organization for Rare Disorders (NORD), www.rarediseases.org
- Nebraska Health and Human Services, Newborn Screening Program, <http://www.hhs.state.ne.us/nsp/>
- New England Consortium of Metabolic Programs at Children's Hospital, Boston, MA, www.childrenshospital.org/newenglandconsortium
- New England Regional Genetics Group (NERGG, Inc.), www.nergg.org
- Nyhan, William and Pinar Ozand. *Atlas of Metabolic Diseases*. London, UK., Chapman and Hall Medical, 1998.
- Online Mendelian Inheritance in Man (OMIM), Johns Hopkins University, <http://www.ncbi.nlm.nih.gov>
- Oregon Department of Public Health, Newborn Screening Program, <http://www.oregon.gov/DHS/ph/nbs/> >
- The Metabolic and Molecular Bases of Inherited Disease: 4-Volume Set
Charles R. Scriver, Arthur L. Beaudet, William S. Sly, David Valle, and Barton Childs. February 2001, McGraw-Hill Companies, 8th Edition.

United States Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau,
<<http://www.newbornscreening.info/>>

Utah Department of Health, Newborn Screening Program,
<<http://health.utah.gov/>>

Washington State Department of Health, Newborn Screening Program,
<<http://www.doh.wa.gov/ehsphi/phl/newborn>>

Wisconsin Department of Health and Family Services, Newborn Screening Program, <http://www.dhfs.state.wi.us/DPH_BFCH/Newborn_Screen/>

