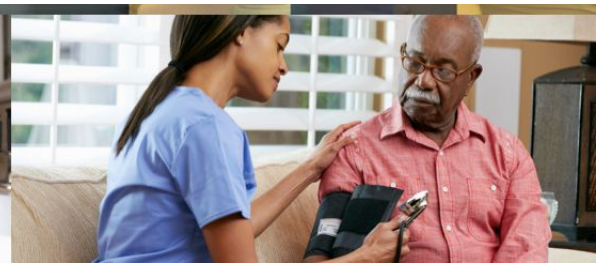




Understanding and Reducing Unsatisfactory Newborn Screening Specimens

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Learning Objectives

This webinar will cover:

- 🔴 Common causes of unsatisfactory specimens.
- 🔴 Proper blood spot collection and handling techniques.
- 🔴 Avoiding collection errors.
- 🔴 Transport best practices.
- 🔴 Strategies to reduce facility unsatisfactory rates.

PRE-QUIZ (Before Training)

What is the ONLY force acting on a passive blood drop?

- A. Random kinetic energy from surrounding air molecules
- B. Gravity
- C. Capillary forces within the paper fibers
- D. Electrostatic attraction between the drop and the paper

A satisfactory dried blood spot is usually shaped:

- A. Perfectly circular with consistent edge thickness
- B. Round to slightly oval with uniform saturation
- C. Irregular with feathered edges from uneven absorption
- D. Distorted or elliptical due to lateral flow

How many punches must be obtained from a newborn blood spot card?

- A. One, if the assay panel is small
- B. Two to four, depending on testing requirements
- C. Eleven, for a full panel of assays
- D. Variable, determined by blood volume and test type

An irregular, bumpy border around a spot most likely indicates:

- A. Multiple blood applications layered on top of each other
- B. Uneven paper absorption due to fiber inconsistencies
- C. Too rapid drying caused by low humidity or high airflow
- D. Minor smearing from handling or card pressure

PRE-QUIZ (Before Training)

What is the most common cause of scratches or abrasions on a dried blood spot?

- A. Mechanical contact with the capillary tube or pipette during application
- B. Accidental folding or creasing of the filter paper before drying
- C. Excessive pressure or scraping when transferring the blood
- D. Surface irregularities in the filter paper

A pinkish “halo” around the blood spot may indicate:

- A. Contamination from serum, antiseptic, or foreign material
- B. Partial hemolysis or diffusion artifact
- C. Residual moisture affecting blood absorption
- D. Minor oxidative changes during drying

The filter paper on the card should always be checked for:

- A. Expiration date or lot number to ensure reliability
- B. Integrity and absence of damage (folds, tears, or contamination)
- C. Proper labeling and orientation for accurate testing
- D. Paper type and manufacturing specifications

Layering in a dried blood spot specimen means:

- A. Adding multiple drops of blood to the same circle
- B. Insufficient blood added, requiring multiple attempts
- C. Collecting blood at different intervals throughout the day
- D. Blood flowing unevenly due to paper folds or handling

Pre Quiz Answers

---Answer Key

1. B. Gravity. (Slide 7)
2. B. Round to slightly oval with uniform saturation. (Slide 8)
3. C. Eleven, for a full panel of assays. (Slide 14)
4. A. Multiple blood applications layered on top of each other. (Slide 15, 18)
5. A. Mechanical contact with the capillary tube or pipette during application. (Slide 20, related to UNS 2)
6. B. Partial hemolysis or diffusion artifact. (Slide 5, option from pre-quiz)
7. B. Integrity and absence of damage (folds, tears, or contamination). (Slide 10, related to UNS 6)
8. A. Adding multiple drops of blood to the same circle. (Slide 9, related to UNS 3)

Why improve specimen quality ?

- Discrepancies Newborn vs. Second screens
- Positivity rates inconsistent with national prevalence data
- False positive results
- Fear of missing enzyme deficiencies (LSDs/Glucosemia)

Inaccurate Results

- How much does it matter?
- Not clear
- No conclusive studies
- Many confounding variables to control

Collection Device Theory

3.2 mm punches are taken from the applied blood spots and used during the newborn screening process



It is estimated that 75 μ L of blood is required to fill one circle.

- With the exception of the screening test for hemoglobinopathies, the Newborn screening assays are quantitative or semi-quantitative.
- Calculations used to determine the final concentration of the analytes in the blood spot assume that each 3.2 mm punch contains precisely 3.1 μ L of blood.
- Any deviation from this volume could result in an unreliable newborn screen result.

Operations Problems

- Special handling
- Repeat testing problems
- Metrics and feedback

Cost Concerns

- “All you can eat” funding model
- All Unsat specimens are tested
- Multiple Unsat specimens increase costs with out value to patients

Care Implications

- Trauma and frustration
- What is the value of the second screen?

How Blood Spot forms?

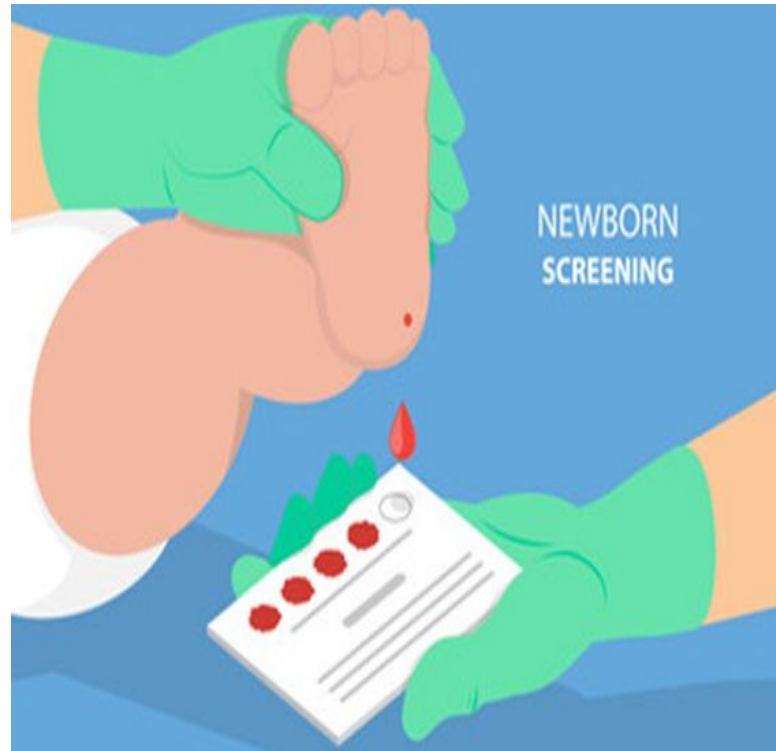
There are three types of bloodstain patterns:

1. Passive
2. Projected
3. Transfer

Blood spot formation

Circular Shape: Due to the absence of external force, passive bloodstains tend to form round or slightly oval shapes

Drip Patterns: Blood dripping from a source due to gravity creates drip patterns. If a person is moving while dripping blood, it can form a trail of passive stains.



Satisfactory Blood spot specimens

A satisfactory specimen is **round** or **slightly oval**.



Unsatisfactory Codes

Most Common Errors

- **UNS 1: Insufficient Blood.** Not enough blood collected to perform all required tests.
- **UNS 2: Specimen Scratched.** Filter paper was scratched or abraded by a capillary tube or the patient's heel.
- **UNS 3: Layered or Clotted.** Specimen appears layered, clotted, or oversaturated (e.g., multiple drops in one circle or visible fibrin clot).
- **UNS 10: Late Arrival.** Sample was received at the lab more than 10 days after the collection date.

Unsatisfactory Codes

Specimen Quality

- **UNS 4:** Specimen streaked with blood clots.
- **UNS 5:** Specimen has serum rings, or appears diluted, discolored, or contaminated by alcohol or formula.
- **UNS 6:** Filter paper stretched, wrinkled during collection, or contaminated by ink.
- **UNS 8:** Blood spot not dried before mailing.
- **UNS 12:** No blood in the circles.
- **UNS 14:** Blood did not elute from filter paper, preventing accurate results.

Unsatisfactory Codes

Identification and Transit

- **UNS 7:** Essential identification, categorization, interpretation, and follow-up information missing.
- **UNS 11:** Specimen damaged or lost in transit.
- **UNS 13:** Specimen received with no patient information.
- **UNS 17:** Discrepancy in patient identification.

Unsatisfactory Codes

Other

- **UNS 9:** Unable to obtain satisfactory test result.
- **UNS 15:** No specimen received. Parental consent refused.

Criteria to Consider when Assessing Specimens for Acceptability

- Size
- Shape
- Texture
- Appearance
- Information on the card

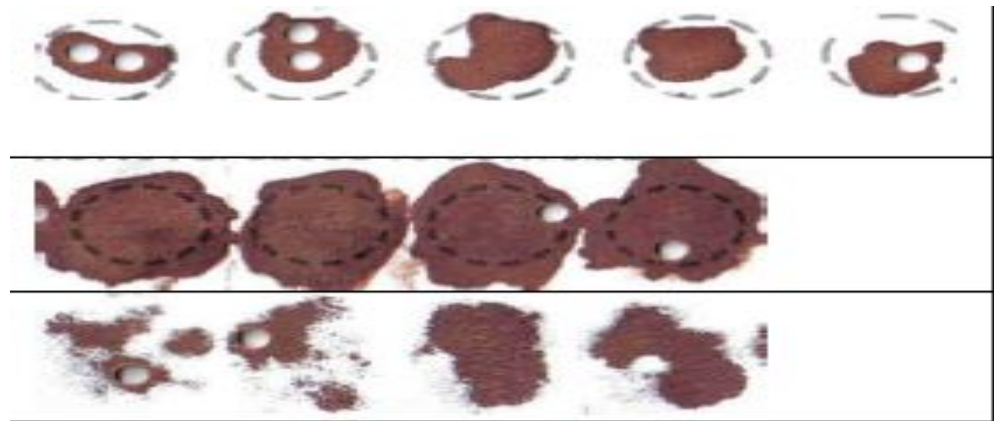
Size

Is there sufficient blood to run all tests? (UNS 1)

- o Quantity
- o Size

Newborn specimens → 11 spots

SUB specimens → 5 spots



Shape

Do the spots appear irregular? Do the spots look slightly oval and if so, do they appear to form another circle within a circle? (UNS 3)

- o Signs of multiple applications
- o Irregular shaped border
- o Misshapen due to angle of application

Shape



Visible lines
indicate
multiple
applications of
blood

Shape



Layered Sample

Background:	Tips to Avoid Layered Samples:
- Layered specimens occur when more than one drop of blood is applied to a circle or blood is applied to both sides of the filter paper. - Layered specimens may cause test results to be inaccurate. A repeat specimen will be required. This can lead to critical delays in identifying serious health issues for the infant.	- Avoid applying additional blood to a circle that is not filled. Do not touch the same circle multiple times with blood. - Do not apply blood to both sides of the filter paper. - Avoid using capillary tubes for specimen collection. If medically necessary, avoid devices containing heparin or EDTA. - Allow a large blood drop to form and lightly touch the drop to the filter paper. Allow the drop to soak through and completely fill the circle.

Layered Images (front and back of the same card):

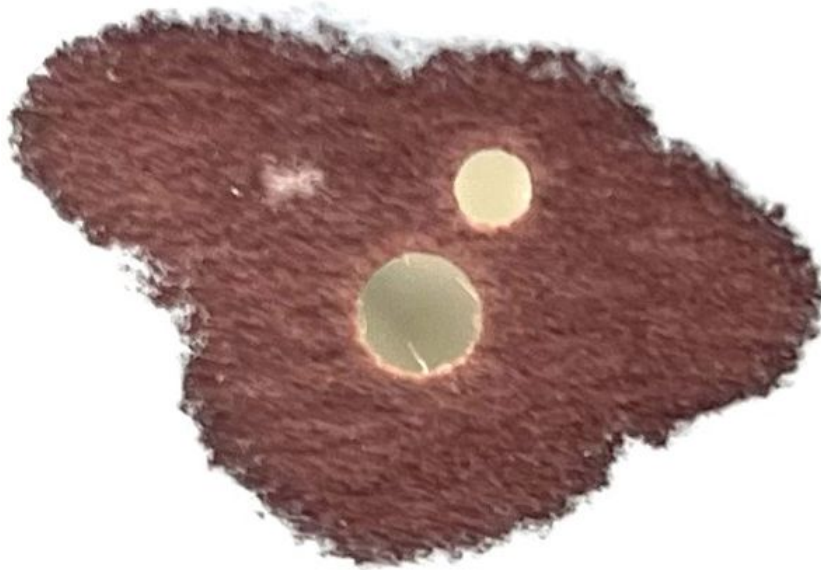


Front of card: More than one drop of blood was applied to each circle.



Back of card: Layering prevented blood from evenly soaking through to back of card.

Shape

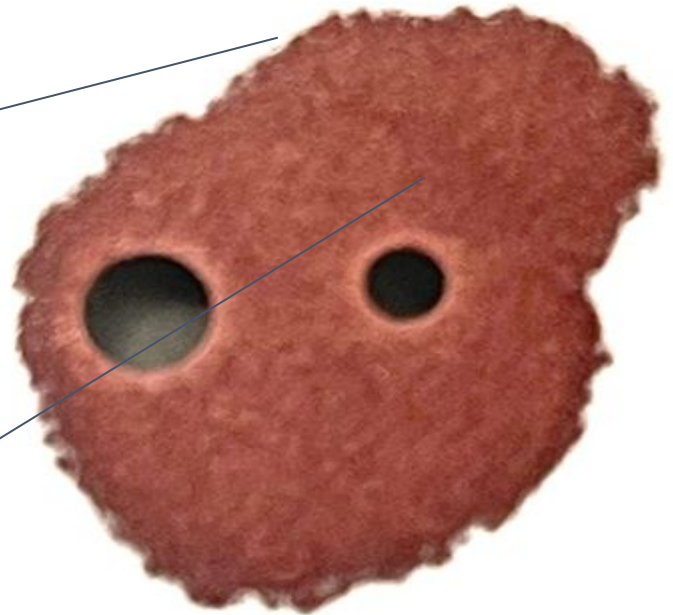


An irregular border indicates a layered specimen (UNS 3)

Shape

The outer layer of the second blood spot is darkened.

This slight curve indicates a layered specimen



Texture

Do the spots appear wrinkled, scratched or abraded?

- o This usually indicates that the blood was applied by a capillary tube. (UNS2)



Blood spot has a fuzzy like texture and appearance.

Texture

- o Filter paper stretched or wrinkled during collection – (UNS 6)



Appearance

Do the spots have clots or appear to be contaminated? Do the spots have a pinkish hue around the specimen border?

- o Layering – UNS 3
- o Scratches– UNS 2 and wrinkles - UNS 6

Appearance

Contamination could indicate serum rings or contamination with antiseptic solution – UNS 5



Appearance of clots – UNS 4



Information on the card

- *Is the filter paper expired?*

(UNS 10)

Exp. Date 2025-07-31
MDH 79

09/04/2025

TEST REQUEST AUTHORIZED BY (PRINT NAME): Submitter Code:

ADDRESS (PRINT FULL ADDRESS):

NURSERY:

BIRTH FACILITY: 1 ☐ HOSPITAL 2 ☒ HOME 3 ☐ OTHER ☐ FT ☐ NICU

BABY'S INFORMATION:

LAST NAME		FIRST NAME		MIDDLE NAME	
[REDACTED]		[REDACTED]		[REDACTED]	

BIRTH DATE: 07/28/25 BIRTH TIME: 11:51:19
BLOOD COLLECTION DATE: 08/22/25 COLLECTION TIME: 11:51:19

MOTHER'S INFORMATION:

USE 24 HR TIME ONLY

Place Submitter Sticker Here
do not cover patient info

Information on the card

Exp. Date 2029-03-31
MDH 79

09/09/2025

Collector's Initials

Test Request Authorized by (Print Name): Submitter Code:

Address to send report:

NURSERY:

BIRTH FACILITY: 1 ☒ HOSPITAL 2 ☐ HOME 3 ☐ OTHER ☐ FT ☐ NICU

GIBMC HOSPITAL NAME

BABY'S INFORMATION:

MR NUMBER HOSP ID

BIRTH DATE 08/14/25 BIRTH TIME 10:00

BLOOD COLLECTION DATE 08/21/25 COLLECTION TIME 10:00

MOTHER'S INFORMATION:

USE 24 HR TIME ONLY

Place Submitter Sticker Here
do not cover patient info

Is the received date greater than 10 days from the date of collection? (UNS 10)

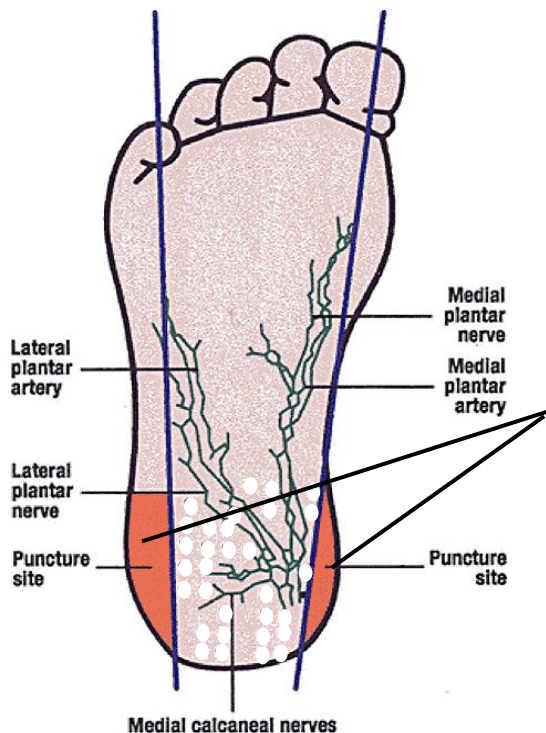
Information on the card

Is the age of the baby 6 months or greater at the time of collection?

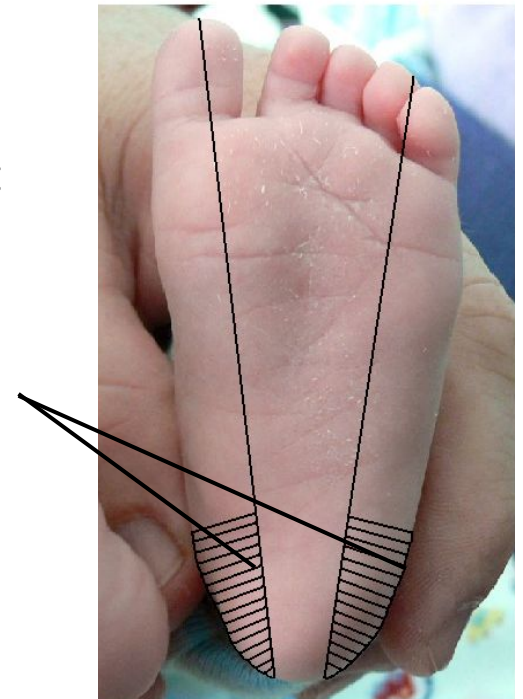
(UNS 10)

Exp. Date 2029-08-31
MDH 79
PKM
Collector's Initials
Test Requisition Authorized by (Print Name):
Submitter Code:
Address to send report:
NURSERY
BIRTH FACILITY: 1 ☒ HOSPITAL 2 ☐ HOME 3 ☐ OTHER ☐ FT ☐ NICU
NAME
OB: 7/3/2020 (5 yrs) Race: Other
pt: 8/29/2025 11:20 AM Loc: JH-104 JHDMR PCP
hdmr Acute A

Recommended Sites for Neonatal Capillary Blood Sampling



- Puncture site should be on the medial or lateral portion of the plantar surface of the heel.
- The plantar surface is the part of the foot that touches the floor if standing or walking.
- The shaded areas show the best sites for puncture.
- Use of these areas will help prevent possible damage to the heel bone and the nerves and arteries noted on the diagram.



Preparation for Neonatal Capillary Blood Sampling

- Warm infant's heel with soft cloth or diaper, moistened with warm water for 3-5 minutes.
- You can also use a heel warmer, if allowed by your facility.
- Place infant's heel in a dependent position, such as Mom cradling infant with head higher than feet.



Neonatal Capillary Blood Sampling



- Cleanse site with alcohol prep and allow to dry
- Puncture heel with sterile lancet which has a puncture depth of <2.0 mm.
- The lancet should be labeled for use in newborn capillary specimen collection
- Wipe away first blood drop with sterile gauze pad
- Allow another LARGE blood drop to form

Neonatal Capillary Blood Sampling

- Direct application of blood onto filter paper is recommended.
- Lightly touch filter paper to LARGE blood drop.
- Allow blood to soak through and completely fill circle with SINGLE application.
- Apply blood to only one side of the filter paper.
- Fill remaining circles by lightly touching one LARGE blood drop to each circle.
- If blood flow diminishes, clean a new site and repeat the process with a new sterile lancet.



Collection Video



Post Quiz

Which of the following is NOT one of the common causes of unsatisfactory specimens listed in the webinar learning objectives?

- A. Common causes of unsatisfactory specimens.
- B. Avoiding collection errors.
- C. Specimen is frozen during transit.
- D. Proper blood spot collection and handling techniques.

According to the presentation, what is the recommended puncture depth for a sterile lancet used in neonatal capillary blood sampling?

- A. Exactly 2.0 mm
- B. Greater than 2.0 mm
- C. Less than 2.0 mm (<2.0 mm)
- D. Variable, based on infant weight

What is the most common cause of scratches or abrasions on a dried blood spot, resulting in Unsatisfactory Code UNS 2?

- A. Accidental folding or creasing of the filter paper after collection.
- B. Contact with the capillary tube or pipette during application.
- C. Rapid air-drying with a fan or heat source.
- D. Contamination with an antiseptic solution.

In addition to a delayed diagnosis, what is another significant impact of an unsatisfactory specimen mentioned in the slides?

- A. Decreased workload for nurses and lab staff.
- B. Reduced financial costs for the healthcare system.
- C. Risk of false-negative results, meaning a disorder could go undiagnosed.
- D. Improved accuracy of the overall newborn screening process.

Post Quiz Cont...

Which of the following describes a satisfactory blood spot specimen?

- A. Irregular with feathered edges from uneven absorption.
- B. A perfectly square shape with darkened borders.
- C. Round or slightly oval with uniform saturation.
- D. Multiple drops layered on top of each other.

Which of the following Unsatisfactory Codes is related to the time between collection and lab receipt?

- A. UNS 1: Insufficient Blood
- B. UNS 7: Essential identification information missing
- C. UNS 12: No blood in the circles
- D. UNS 10: Late Arrival

If a blood spot has a fuzzy-like texture and appearance, what is this most likely indicative of, according to the presentation?

- A. The specimen was dried too slowly.
- B. The blood was applied using a capillary tube.
- C. The infant had a high white blood cell count.
- D. The filter paper was expired.

The recommended site for neonatal capillary blood sampling is the plantar surface of the heel. What is the critical preparation step mentioned for this site prior to puncture?

- A. Applying an ice pack for 3-5 minutes.
- B. Warming the infant's heel with a soft cloth for 3-5 minutes.
- C. Applying a tourniquet to the ankle.
- D. Immediately puncturing the heel without cleansing the site.

Post Test Answers

-----Answer Key

1. C. Specimen is frozen during transit. (Slide 3)
2. C. Less than 2.0 mm (<2.0 mm). (Slide 22)
3. B. Contact with the capillary tube or pipette during application. (Slide 5, 20)
4. C. Risk of false-negative results, meaning a disorder could go undiagnosed. (Slide 6)
5. C. Round or slightly oval with uniform saturation. (Slide 8)
6. D. UNS 10: Late Arrival. (Slide 9, 21)
7. B. The blood was applied using a capillary tube. (Slide 20)
8. B. Warming the infant's heel with a soft cloth for 3-5 minutes. (Slide 21)

Newborn Screening Program Resources and Contact Information

Educational Materials:

- Fill out the [request form](#) to receive education materials.

Collaborative Review: (discuss site-specific metrics, including unsatisfactory rates, specimen transit times, and operational processes). Sign up [here](#)..

Stay Up to Date:

- View our [website](#) for the latest newborn screening program information.
 - Newsletters
 - Webinars
 - Family and Provider resources



Questions?

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