

Mission Unleaded: How to test children for lead with maximum accuracy

SCENE 1: PRODUCTION STUDIO

[An 11-year-old boy CASEY and a four-year-old girl LANE face the camera. The four-year-old fidgets and looks all around her.]

>> CASEY: (to four-year-old) Lane, look here. Okay, look right here. Okay?

[CASEY points to the camera.]

[LANE looks where CASEY is pointing and smiles.]

>> LANE: Casey, where's my sticker?

>> CASEY: Your sticker's coming, okay?

>> LANE: You said I get stickers if I do this.

>> CASEY: And you will get your sticker, okay?

>> DIRECTOR (off screen): Anytime you're ready.

>> CASEY: Hi, I'm Casey and this is my little sister, Lane. The Centers for Disease Control...

>> LANE: CDC!

>> CASEY: Yeah...the CDC asked us to be in this video. It's about testing kids like us to see how much lead is in our blood.

>> LANE: And stickers!

[LANE breaks into a brilliant smile.]

>> CASEY (to camera): Okay. Medical professionals like you like to test kids' blood to make sure there's not too much lead. And you've done a really good job.

[MOTION GRAPHIC: On Casey's left, serious effects of lead begin to scroll from the bottom of the screen to the top: Encephalopathy...Nephropathy...Frank Anemia...Decreased hemoglobin synthesis...Increased vitamin D metabolism...Increased risk of hypertension...]

>> CASEY (indicating the scrolling words with his hand): But here's some of the bad things that can happen if a kid has too much lead in their blood. But they don't happen very much today. Thanks, in part, to blood testing. And thanks to you.

[The adverse effects dissolve from the screen.]

>> CASEY: But the fact of the matter is, there really is no amount of lead that's safe for Lane and me. Even low amounts of lead can harm us.

[ART CARD: A test tube containing lead in blood. Copy describes the adverse effects that can happen at this level of lead or less.]

Developmental Toxicity

-- Decreased IQ levels and academic abilities

-- Attention-related behaviors

-- Anti-social behaviors

>> CASEY: Any amount of lead can harm our future. Our IQ. Our ability to concentrate. And even the that way we treat other people. And we do not want that.

>> LANE: We want stickers!

>> CASEY: Lane's going to get her own test for lead soon. And when she does, the amount of lead that'll be considered high will be less than what it was when I got my blood tested. In fact, it'll be less than half as much.

[ART CARD]

Former level: ≥10 µg/dL <- When Casey was tested

2012 level: ≥5 µg/dL

New level: ≥3.5 µg/dL <- Today's reference level

>> CASEY: This will help Lane and kids like her. But it'll be a little bit tougher for you guys to measure. You'll have to do some new things to make sure the results you get are really right. And I'm 11, so I don't understand it at all. So we brought in a nurse and a plebla...phebotm...

>> DIRECTOR (off screen): Phlebotomist

>> CASEY: Yeah, phlebotomist, what he said, to explain.

SCENE 2: SWIMMING POOL

[Extreme close-up of the bowl of a black plastic spoon. It's has about a quarter teaspoon of salt. Widen slowly to two-shot of NURSE and PHLEBOTOMIST, revealing the spoon is being held by PHLEBOTOMIST.]

>> NURSE: Hi, my name is Shayla. I'm a nurse. And this is Laura.

[PHLEBOTOMIST nods but does not speak.]

>> NURSE: The problem with lead is that it's everywhere. So as we test for smaller and smaller amounts of lead in the blood, contamination of a patient's sample becomes a bigger and bigger concern. For example, lead contamination the size of one tenth of a grain of salt in a three milliliter blood sample can raise that sample's lead content by one microgram per deciliter. For you math geeks, here's the equation.

[As she describes the equation, calculations are quickly scratched out on the screen.]

$1\mu\text{g}/\text{dl} \times 10\text{dL}/\text{L} \times 1\text{L}/1000\text{mL} \times 3\text{mL} = 30\text{ng}$

>> NURSE: Everyone got that? Here's another way to think about it. Let's imagine the 25 grams of salt in this spoon represent lead the size of 1/10th of a grain of salt in a 3 milliliter blood tube.

>> NURSE: And think of this pool, all 660,000 gallons of water in it, as your sample.

[PHLEBOTOMIST has a "how did I get roped into this?" look on her face.]

>> NURSE: If this 25 grams of salt gets in the pool...

[NURSE looks at PHLEBOTOMIST as if to say, hey, that's your cue. PHLEBOTOMIST looks back as if to say "oh well" and hops into the pool.]

>> NURSE: That tiny bit of contamination may very well be the difference between an accurate result and a result that's falsely elevated.

[PHLEBOTOMIST climbs out of the pool. She does not look happy.]

>> NURSE: Nice work.

>> PHLEBOTOMIST: I couldn't have just poured the salt in?

>> NURSE: Oh, yeah. I guess we could have done that.

[NURSE breaks into a mischievous smile.]

SCENE 3: EXAM ROOM

[NURSE and PHLEBOTOMIST face the camera.]

>> NURSE: Okay. We're back in more familiar surroundings to talk about blood testing.

>> NURSE (to PHLEBOTOMIST): And you've dried off?

>> PHLEBOTOMIST: I have. And the director said I'd be paid extra because that was technically a "stunt."

>> NURSE: Okay. So let's talk for a second about what this new reference level means for people like you and me, whose job it is to do blood draws every day.

>> PHLEBOTOMIST: Okay, this I can handle. So, there are some new words we're being asked to use when we talk about testing for lead in blood. "Reference level" is basically what we used to call the "level of concern."

>> NURSE: That's the amount of lead in a child's blood at which we start to consider doing some type of action to reduce a child's exposure to lead.

>> PHLEBOTOMIST: The old reference level, or what we used to call the "level of concern" was 10 or more micrograms of lead per deciliter of blood. Then the reference level moved down to 5 micrograms per deciliter. Now it is 3.5. And the big issue when you bring the reference level down that low is contamination of the patient's sample.

>> NURSE: Yeah, and as we saw at the pool, it only takes a very small amount of lead from the external environment to get into the patient's blood sample somehow to change the result. In other words, push it over the edge to a level that's too high and not accurate.

>> PHLEBOTOMIST: Exactly. And that means we have to take some additional precautions, do some things in new ways. And that's not always easy for us. We like routine. We do procedures a certain way, and every time we have to adjust or adapt to a different way, one thing you worry about is time.

>> NURSE: Right. How long will these new techniques take? And then, are these techniques going to make each blood draw take longer? Will it to slow me down, make me less efficient?

>> PHLEBOTOMIST: Sure. And then, any time you change a routine there's a learning curve. And while people are learning, they can make mistakes.

>> NURSE: And no one wants that.

>> PHLEBOTOMIST: You know what I need to know? I need to know how to do these things as simply and easily as possible.

>> NURSE: Fair enough. We'll take a look at how to do that in our next section. But for right now, we're going to explain that new terminology

SCENE 4: PRODUCTION STUDIO

[NURSE and PHLEBOTOMIST stand behind a table that holds a 10x10 layout of strawberries.]

>> NURSE: So, we have 100 strawberries in front of us, and we're going to use them to discuss some updated terms when talking about blood lead testing.

>> PHLEBOTOMIST: We've been using "reference level" instead of the former term "level of concern." First of all, no matter what kind of level we're calling it, what is this "level"? What does it mean?

>> NURSE: Basically, it's a way to tell if a child has had exposure to lead.

>> PHLEBOTOMIST: And by exposure to lead, we mean ingesting or inhaling it.

>> NURSE: Exactly. So what happens is that every four years CDC analyzes recent data from the National Health and Nutrition Examination Survey.

>> PHLEBOTOMIST: Those are interviews, physical examinations, and lab tests that assess the health and nutritional status of children and adults in the U.S.

>> NURSE: Right. And then what CDC does is take that data and says, okay, what's the amount of lead that's equal to or less than the amount of lead of 97.5 percent of U.S. children between the ages of one and five. So if we just go to our strawberries here, we can count backward from 100. 100, 99, 98...

[NURSE picks up a knife and cuts the third strawberry in half.]

>> NURSE (to strawberry): Sorry, guy.

>> NURSE (to camera): 97.5 percent. So basically this point, midway between this strawberry, is the reference level.

>> PHLEBOTOMIST: And in the past, the level was greater than or equal to 10 micrograms per deciliter.

>> NURSE: Right. And in 2012, it was lowered to greater than or equal to 5 micrograms per deciliter based on survey data. Now it's greater than or equal to 3.5 micrograms per deciliter.

>> PHLEBOTOMIST (indicating the two and a half strawberries): And what about these strawberries here? And poor half strawberry here?

>> NURSE: Well, these 2.5 strawberries represent the percentage of children who have a lead level at or above the reference value.

>> PHLEBOTOMIST: Would they need treatment of some kind?

>> NURSE: Well, they could, depending on how far above the reference level they are, and what the medical recommendations are in their case.

>> PHLEBOTOMIST: In fact, families can make some changes around the home even for kids who are below the reference level, right?

>> NURSE: Right, because there's no level of lead that's considered to be okay. But the reference level -- the level where we warn parents -- is a level that's seen in a small percentage of children.

>> *NURSE: indicates the 2.5 strawberries.*

>> PHLEBOTOMIST: The 2.5 strawberries here, in other words, 2.5 percent.

[PHLEBOTOMIST indicates the 2.5 strawberries.]

>> PHLEBOTOMIST (picking up the halved strawberry): I don't think we can help this guy, though.

>> PHLEBOTOMIST: Tasty!

SCENE 5: EXAM ROOM

>> NURSE: As you see, we're all set up with everything needed for a blood draw, and we're going to look into what we need to do to really prevent lead contamination as much as we possibly can.

>> PHLEBOTOMIST: First, make sure that the collection area is as clean as you can get it. Wash down the collection area. All of the packaging is sealed until just before you're going to use it. You can also cover your materials until you're ready to use them.

[LEFT THIRD. Routinely wipe the surface with a disinfectant and then cover the surface with a clean disposable pad for each patient.]

>> NURSE: You're trying to make your collection area as lead-free as possible. Anything the patient's blood comes in contact with needs to be lead-free.

>> PHLEBOTOMIST: Which begs the question: What do terms like "sterile" or "lead-free" mean on a vacutainer box or a lancet package?

>> NURSE: (picking up a vacutainer box): "Lead-free" may or may not mean lead-free enough for our current reference level. And, of course, "sterile" does not mean lead-free. So if it just says "sterile," that's not going to cut it.

>> PHLEBOTOMIST: The best practice here is to have items in your collection process pre-screened for lead.

[ART CARD: Pre-screened means the new supplies are tested in batches to ensure there is no lead contamination.]

>> PHLEBOTOMIST: The next best alternative is to find out the upper allowable limit of lead allowed by the manufacturer for the device you're using.

>> PHLEBOTOMIST: These are suggestions you can make to whoever orders your blood collection supplies.

>> NURSE: Okay, but now we have a patient waiting, and we need to think about how our actions might lead to lead contamination.

[NURSE gestures toward a paper towel dispenser. It's covered by red tape that forms a large "X." PHLEBOTOMIST is already standing there, puzzled. She looks at NURSE, disapprovingly.]

>> PHLEBOTOMIST: Really?

>> NURSE: I was trying to make a point

>> PHLEBOTOMIST: I think I know where you're going with this. Some paper towels are made from recycled materials that can contain trace metals. So if you dry your hands with them, or dry the patient's hands with them, or they touch anything that's going to come in contact with blood collection devices or the blood sample itself, they can cause contamination.

>> NURSE: So steer clear of paper towels when drawing blood to test for lead.

>> PHLEBOTOMIST (looking at the red tape): But really, no need to do this. Just remember: paper towels equal possible contamination.

>> NURSE (to camera): Here's a reminder of everything we just discussed.

[Cut to graphics on screen that make these same points.]

Use blood collection supplies that are pre-screened or known to be "lead free."

That means every item the blood comes into contact with, not just the blood vacutainer or vial.

If this is not possible, use supplies and devices that the manufacturer describes as "metals free."

Go to the FDA website to see if any supplies or devices have been recalled.

Do not use paper towels when drawing blood to test for lead.

Communicate with management about needs for pre- screened or lead-free collection supplies.

SCENE 6: BACKSTAGE AT PRODUCTION STUDIO

[NURSE and PHLEBOTOMIST are standing by a monitor, looking at CASEY and LANE waiting in the exam room.]

>> PHLEBOTOMIST (turning to talk to camera in a whisper): Remember Lane? Now we're actually going to collect her blood for testing.

>> NURSE: The point isn't to demonstrate how to do a blood draw, because you know that. We just want to highlight the key points that can minimize lead contamination.

>> PHLEBOTOMIST: And here's a key thing. A lot of times we draw blood for a variety of reasons, not just for lead. When you're doing that, always draw the lead sample first.

>> NURSE: I know many of you are trained to take blood for the vials that don't have anticoagulant first and then move to the metals tube. But it's very important to take the lead sample and fill the lead tube first.

>> PHLEBOTOMIST: And now I'm going to demonstrate why that's important, using some tortilla chips and a bowl of guacamole.

SCENE 7: KITCHEN

[PHLEBOTOMIST is alone in the kitchen. On the kitchen island is a bowl of guacamole with plastic wrap over it, and a sealed bag of tortilla chips.]

>> PHLEBOTOMIST: Testing for lead is different than testing for other agents, say, thyroglobulin or hemoglobin. There's probably no thyroglobulin or hemoglobin around me, so I don't have to worry about contaminating my sample if I'm testing for those things. But lead is like bacteria, it can be anywhere, no

matter how careful I am. So, let's say I want to dip into this guacamole and pick up as little bacteria as possible.

>> PHLEBOTOMIST (doing the actions as she speaks): I'm the first one here. I'm the first one to open the bag. I'm the first one to take a chip, First to uncover the dip and first to dip.

[PHLEBOTOMIST eats the chip. Makes a satisfied "yummy" sound.]

>> PHLEBOTOMIST: But watch this. Hey y'all -- anyone want some chips and guac?

[A stampede of people come through to grab chips. We see hands reaching into the bag, chips drop on the counter, others pick them up to dip, some fingers get in the guacamole. Once they leave, it's a bit of a mess.]

>> PHLEBOTOMIST: Obviously there's more chance of contamination if you take other blood samples before the lead sample.

>> PHLEBOTOMIST (yelling to the other room): You're welcome!

[NURSE walks in and looks at mess.]

>> NURSE: Point taken. Take the lead sample first. And that's the case whether you're doing a finger stick, or an intravenous blood draw, which we'll talk about in a bit.

>> PHLEBOTOMIST (looking at mess): You get to clean it up.

>> NURSE (exasperated expression): Fine.

SCENE 8: EXAM ROOM

[CASEY, LANE, NURSE and PHLEBOTOMIST are all in the exam room. PHLEBOTOMIST is dressed to do a blood draw.]

>> PHLEBOTOMIST (turns to talk to camera): So, now the scene you've been waiting for -- the blood draw. I've washed my hands, opened the supplies I'm going to need, and put on gloves. Shayla is helping Lane wash her hands.

>> NURSE: We're not going to dry Lane's hands with anything. She's just going to shake them dry.

>> NURSE: (to LANE): Okay, honey. Can you shake your hands like this?

[LANE mimics NURSE.]

>> PHLEBOTOMIST: And don't touch anything now, sweetie. Just keep your hands up like this, okay?

[PHLEBOTOMIST takes LANE's hand.]

PHLEBOTOMIST: I'm not going to do anything yet, okay? Can you fold these fingers over for me? Keep this one out.

>> NURSE (whispering to camera and away from LANE): So these are all steps you know. Laura is going to use the ring or middle finger, so usually the stick is slightly lateral where the skin may be thinner and may be less painful. So Laura is massaging the finger gently to get blood flowing.

>> PHLEBOTOMIST: Alright, just gonna be a little stick, okay?

[PHLEBOTOMIST sticks LANE's finger and tosses the lancet in the sharps container.]

>> PHLEBOTOMIST (to LANE): Good job!

>> NURSE (whispering to camera): Laura's is not going to take the first drop of blood. She's just going to let it drop onto this gauze pad. She's not going to wipe; she's just going to let it drop. If you wipe and there's a little lead on the fingertip, then that can get into the first drop. And then that drop may wash whatever's left away.

[PHLEBOTOMIST holds a collection vial up to the puncture site.]

>> PHLEBOTOMIST: So we can start sampling after that first drop. I'm going to hold my container at about a 10 degree angle to start collecting blood. And again, to really minimize chances of contamination, I don't want to touch the container to the finger. If you have a microcontainer with a capillary collector, you want to avoid placing the capillary collector on the finger.

[PHLEBOTOMIST shifts the collector to vertical.]

>> PHLEBOTOMIST: Now I'll hold my collector straight up and down and let the blood flow in until it fills the container or reaches the indicated level. If the blood isn't flowing well, I'll gently massage the finger. I don't want to excessively squeeze the finger.

[Closeup on PHLEBOTOMIST massaging LANE's finger.]

[The blood sample fills the container.]

>> PHLEBOTOMIST: And now I have my sample and I'll just seal it with the attached push cap. If I have a microcontainer with a capillary collector, I'll remove the capillary collector, seal it with the push cap, and toss the capillary collector in the medical waste container.

[PHLEBOTOMIST LANE's finger stick then inverts the container several times to distribute the anticoagulant. CASEY walks up to NURSE.]

>> CASEY: So does my sister have too much lead or what?

>> NURSE: Oh, honey, I don't know. We have to send it to be tested. We just have to wait.

>> CASEY: For how long?

>> NURSE: Oh, just a few days.

>> CASEY: Okay, so here's the deal: I kind of promised her some stickers, so...

>> NURSE: Stickers, huh? Okay, well...

[NURSE hands CASEY a sheet of stickers.]

>> CASEY: Awesome! We probably need enough for me, too.

>> NURSE: Well...you earned them.

[NURSE hands CASEY a second sheet of stickers. PHLEBOTOMIST looks hurt and left out.]

>> PHLEBOTOMIST: Seriously?!

>> DIRECTOR (off screen): I like stickers

>> NURSE: No! This is my last sheet.

[NURSE hugs the sheet to her chest]

[Everyone giggles.]

SCENE 9: LABORATORY

[NURSE and PHLEBOTOMIST walk into the lab, where a sample is sitting on the counter.]

>> NURSE: Everything you do right - or wrong - when drawing blood shows up in the lab.

>> PHLEBOTOMIST: Contamination is a huge risk when you're measuring an amount as small as 3.5 micrograms per deciliter. The critical thing is to keep extraneous lead out of the sample in every way possible. When you do each of these steps we just saw, you realize that each one is critical in eliminating a possible source of contamination.

>> NURSE: Right. Each one is like another line of defense.

>> PHLEBOTOMIST: And you need to do each one right, because you're working with such a small margin of error. Doing every step correctly helps achieve an accurate result.

>> NURSE: And accurate results mean less anxiety for the patient and parents. You avoid retesting and costs involved with that.

>> PHLEBOTOMIST: When test results are inaccurate, people lose faith in the test. If healthcare providers lose confidence in blood lead test results, they may be reluctant to test children for lead.

>> NURSE: Speaking of results, if you do get a result that's at or above the reference level, what's done to confirm those results?

>> PHLEBOTOMIST: A confirmatory test is always done with a venipuncture, not a finger stick. All the precautions are basically the same, and don't forget to always take the lead sample first if you're drawing blood for multiple tests.

>> NURSE: So let's remember what we just covered.

[ART CARD]

During the Blood Draw:

Unwrap/open all device packaging immediately before use.

Use soap to wash patient's hands.

After washing, only let the patient air dry their hands.

Instruct the patient to avoid touching anything after washing their hands.

Let the first drop of blood fall onto a gauze pad

Do not touch the collection container to the patient's finger.

If drawing for multiple tests, draw and fill the lead tube first

[Cut back to clinical setting.]

>> PHLEBOTOMIST: And that's it, really. Once you get your sample, it's just a matter of labeling and storing it properly, and sending it to the lab.

>> NURSE: It's a lot work, isn't it? Having this lower reference level.

>> PHLEBOTOMIST: Well, it's probably best to be cautious. No study has found a safe level of blood-lead for children. There's a recent study on the effects of lead in children in utero, so whatever lead levels we have can affect our unborn children. So I think there's a good argument for reducing blood-lead levels as much as we humanly can.

>> NURSE: I think it's about patient care. We all want to do the best for our patients.

>> PHLEBOTOMIST: Yes, and if we can meet this stricter standard, we'll end up with test results that truly reflect the amount of lead that's actually in a child's blood.

>> NURSE: And a more accurate test means fewer re-tests, less stress for parents and their children, and less money spent on re-testing. And that comes back to the question of how to convince supervisors that you may need to re-order some inventory to be up to standard. If they see these benefits start happening, they might see it as an investment.

>> PHLEBOTOMIST: I think, overall, it can increase the healthcare community's confidence in blood-lead testing, and that means more children may be screened.

>> NURSE (pointing to camera): Well, these people can be a part of that.

>> PHLEBOTOMIST: Yes. Thank you all for watching.

>> NURSE: The rest is up to you. Here's the CDC's web page on lead, where you can find more information.

[ART CARD: URL and visual of Website: <https://www.cdc.gov/Lead/>]

>> NURSE: So, you want to go to the pool now? We could do another demo.

>> PHLEBOTOMIST: This time I'm tossing you in.

>> NURSE (as they exit): Fine.

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