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John Williams: Hi, everyone. [I'm John Williams](#), professor of pediatrics and chief of the Division of Pediatric Infectious Diseases here at the Children's Hospital of Pittsburgh.

Stephanie Dewar: [I'm Stephanie Dewar](#), vice-chair of Clinical Affairs and program director of the Pediatric Residency Training Program.

Stephanie Dewar: Welcome to That's Pediatrics from UPMC Children's Hospital of Pittsburgh.

John Williams: Our guest this week is the division director of child advocacy Professor [Rachel Berger](#), who is a pediatrician and a specialist in the area of child abuse and child advocacy. She's here this week to talk to us about a recent study of hers that may change the way that we take care of children who have suffered injury, as well as to talk about some things that she's doing within the [Children's Hospital of Pittsburgh](#) and the UPMC system.

Stephanie Dewar: Dr. Berger, it's very exciting, your recent article in JAMA Pediatrics, specifically about a biomarker or blood test that's available to help physicians evaluate the possibility of abusive head trauma. I'm just wondering if you could share a little bit about that and what the background is and your motivation to that study.

Rachel Berger: It's nice to be here today. Sure, I'd be happy to talk about this article. This article is talking about something which we've been working on actually for more than a decade. What we've been trying to do is develop a way to help pediatricians know when they need to think about brain injury in infants.

Rachel Berger: In adults, if you come in and you say, "I just got hit in the head with a hockey puck," somebody can say, "Oh, I think I'd better see whether or not you have a brain injury." But if an infant comes in and they're fussy or they're irritable or they're vomiting, symptoms which clearly could happen from brain injury, but nobody says the child got injured or something happened to this child, as a physician, you probably wouldn't be thinking about brain injury on the top of your list. You probably would be thinking about they might have a stomach flu, they might just have colic, which probably is the most likely thing. But sometimes infants with vomiting or irritability or fussiness may be that way because they have a head injury, and blood in your brain causes those kinds of symptoms, a headache. If you're an infant, you can't say, "I have a headache," so you just get very fussy or you might vomit.

Rachel Berger: So what we've been trying to do for about the last 10 years is to develop a way that physicians could check the blood, just like you check the blood to see if your liver is okay or your kidney is okay, and this would be a way to check

whether the brain might be the source of that infant's symptoms. This article was really a culmination of many years of research.

Rachel Berger: This specific article, what we did was we enrolled over a thousand infants at three children's hospitals around the country, Children's Hospital of Pittsburgh, Lurie Children's Hospital in Chicago, and Primary Children's Medical Center in Salt Lake City, and we enrolled infants who came into the ER at any of those hospitals with these kinds of symptoms. They didn't have a fever, but they were fussy or they were vomiting and they had a symptom that could have been head injury, most likely was not, but could have been. We drew their blood and we looked at their brain, and we measured a set of biomarkers which we had studied previously and we thought would probably work to see whether we could predict which small group of these children actually had a brain injury.

Rachel Berger: What we found was we could identify very well, with a sensitivity of almost 90%, so 90% of the time we could tell that an infant had blood in their brain, even though they otherwise looked well, they were just a little bit fussy, and they probably would have gone home without any imaging of their brain. But this could say to the doctor, look, these values are very abnormal; you need to image the brain.

Rachel Berger: Then in terms of how specific it was, which means how many children who didn't have brain injury would get a brain image, it actually was about 50% specific. So for every infant that needed to get a head CT or brain image and got one, another two would get one that didn't end up needing one. Actually, what was interesting is, overall, some of these head CTs were done for clinical practice and some of them we did for research. We actually would have slightly decreased the number of head CTs overall in these infants, but we identified many more children who actually needed them. That's the goal, is to target the head CTs to infants who need it so doctors know which of the vomiting babies or irritable babies should be getting a head CT or a brain image, some kind of brain image.

Stephanie Dewar: So it basically helps in two regards. It helps the physician to minimize unnecessary tests, but also to be sure to not miss that child who's at risk based on that biomarker results.

Rachel Berger: That's exactly right. We're targeting the head CT or the brain MRI to the right infants, and that's particularly important because infants are the group whose brain is going to be most sensitive to ionizing radiation from a head CT, so you really don't want to do a head CT if you don't need to.

John Williams: Dr. Berger, why are physicians, and I say this as somebody who before doing infectious diseases, I worked as an ER physician for a few years, why are physicians not more commonly recognizing this or thinking about brain injury or head trauma in babies?

Rachel Berger: I think there's a couple reasons. I think one is the reality is this is a little bit like searching for something in your luggage at the airport, where most of the time, even if you didn't have any screening, there would be no problem because there's nothing bad in people's luggage, and only in a very rare case is there actually something you need to pick up with screening.

Rachel Berger: The reality is most infants with vomiting don't have a brain injury, and most infants with irritability are just colicky. So part of this is the needle in the haystack, and that is always very difficult for an ED physician because you're trying to pick out the one baby whose vomiting is not due to something, just a normal gastroenteritis or just being a baby, and is due to a head injury. I think that's part of it.

Rachel Berger: I think there's also the issue that when you're thinking of blood in the brain, you're thinking about child abuse. I think that when people see children, we know that many, many times they don't think about child abuse as a possibility because they see a baby who, for example, has no bruises, and most babies who have abusive head trauma, or what used to be called shaken baby syndrome, have no injuries on the outside and can look very well.

Rachel Berger: So physicians don't think about child abuse partly because the babies look so well, and partly because we have our own biases about who might be abused. There's lots of studies that show that we don't screen infants, for example, who are Caucasian. We screen infants who are African-American with much higher proportions with the same symptoms. We are less likely to screen infants with married parents because of our own biases about who might be an abused infant.

Rachel Berger: I think there's a lot of issues, but I think the most important one is that the reality is that abusive head trauma is going to be rare for any average emergency room physician, even one working at a pediatric emergency room. We have about, at Children's Hospital, about 30 cases of abusive head trauma a year. That's relatively small. We see 80,000 children in our emergency room. But you don't want to miss any of those children. That's the issue.

Stephanie Dewar: Are there processes in place or initiatives underway at UPMC to help physicians who are seeing this large group of patients who may have a significant injury?

Rachel Berger: We've been working for a long time. The biomarkers or the blood tests are just one potential way to identify abuse, and it's just one type of abuse. We're looking at abusive head trauma. But abuse overall, whether it's physical abuse, neglect, sexual abuse, is much, much more common than abusive head trauma.

Rachel Berger: So a lot of the work we've been doing at Children's and throughout the UPMC system has focused on the much broader question of how we can help physicians and advanced practice providers and nurses and other professionals to identify child abuse in general, and how we can help them know how to

evaluate those children, but with the same goals in mind. We want to identify as many children as possible, but minimize overreporting, minimize the number of tests we do in children who aren't abused. So it's the same bounce as with the biomarkers, but with a much broader group of children.

John Williams: It sounds like part of the goal is to get around the biases, because to touch back on the point you made, I'm guessing from the way you presented that, that, as physicians, our biases are probably incorrect about which infants and children are at risk for abuse or for injury.

Rachel Berger: I think some biases are... I think we don't realize. Some of these are implicit biases. I don't think we realize that we have these. Some of them are clearly incorrect. I think one of the most obvious examples is race. There are multiple studies show that we are more likely to screen African-Americans than Caucasian infants with the same injuries. An infant with a fracture or an infant with a bruise or an infant with a brain injury, we are more likely to screen them for child abuse if they're African-American.

Rachel Berger: What's a little bit different here is we're actually probably screening African-American children the right way and we are underscreening Caucasian children, because once we do get those screening tests, it is more likely that we will find other injuries in Caucasian children and ultimately diagnose abuse. It's a little different than most other diseases in that respect. But that bias, for example, race, is not related to the rate of child abuse. That's a bias that is not supported by data.

Rachel Berger: The relationship between socioeconomic status is a little bit more difficult because there clearly is a relationship between poverty and child abuse. However, the vast majority of people who live in poverty do not abuse their children. That is why that bias is still a significant problem.

Rachel Berger: What this screening tool, this biomarker panel, and much of what we've been doing throughout UPMC, which we can discuss a little more, is to try to decrease those biases so that we are fairly and objectively screening the children who need to be screened for child abuse.

Stephanie Dewar: I would be interested in hearing about what it is that you're doing throughout the UPMC system just to facilitate more consistent and thorough evaluations that would be necessary.

Rachel Berger: In the UPMC system, I should say that a couple years ago, about four years ago, we received a grant from the Patient-Centered Outcomes Research Institute, which is a federal granting agency which is actually part of Obamacare. The goal of this grant was to decrease racial disparities in screening for physical abuse, and to do this through the use of the electronic health record.

Rachel Berger: We set up two different systems to help in the identification, evaluation, and reporting of child abuse in the electronic health record. There's actually two distinct systems within UPMC because our Children's Hospital actually has a different version of Cerner than the rest of our hospital system. So we have two different systems running, although they have a lot of similarities.

Rachel Berger: In our Children's Hospital, we have what's called a trigger system, so that there are certain things coded into our electronic medical record that, when present, cause an alert to be shown to the physician that, hey, you should think about child abuse, in the same way if I try to put an order in for a medication that the child has an allergy to, it's going to give me an alert saying, are you sure you really want to write this medication?

Rachel Berger: So we have coded certain things into our system. For example, if I have an infant who comes in, and their chief complaint, they come in from an outside hospital, is fracture, that should alert the physician because an infant who doesn't walk should not have a fracture, and I should be thinking about abuse.

Rachel Berger: Some of them are a little bit more fancy. For example, if I have an infant who gets an X-ray of their leg, and then two hours later I input some order for sedation medications, the system says, huh, I'll bet you called because you need to... You put the sedation orders in because you need to cast a fracture. Oh, look, they have a fracture. I'm going to alert the physician.

Rachel Berger: So there's multiple triggers that are embedded into our electronic health record that alert the physician. When those occur, the physician gets a pop-up and they have to respond to it. They have to say, "Yes, I'd like to evaluate for abuse," "No, I don't want to do it now, but keep reminding me every time I come back into the medical record," or "Nope, I never want to evaluate for abuse." And if they say that, they have to say why. They have to click why.

Rachel Berger: If they want to, they can get directly brought to a set of orders, and those orders tell them to do the tests the American Academy of Pediatrics wants them to do, but no more tests and no fewer tests. For example, we used to have many more children getting head CTs than really needed them by the American Academy of Pediatrics guidelines, or we had children maybe getting neck CTs who didn't need them. Now the physicians know exactly what orders they should be putting in.

Rachel Berger: This system we studied, it works. Our physicians like it. It improves our compliance with the guidelines. It has been part of our practice at Children's since the end of 2015. So most people who are residents here, for example, do not remember before this system existed. They just know this is how we do it.

Rachel Berger: Several years after that, we started to look at the adult hospitals, our general EDs, because the reality is that most children are not seen in pediatric emergency rooms. Most children with abuse will be seen, and in fact, most

children who have misdiagnoses, where they have abuse and a physician doesn't recognize it, will be seen in a general ED, simply because more children are seen in general EDs than in pediatric EDs.

Rachel Berger: In our general EDs at UPMC, we again have multiple different systems. They're different than at Children's Hospital because we have a different Cerner system, which is our electronic health record. For example, our general EDs have a universal child abuse screen. We are the first hospital system that I'm aware of that has a universal child abuse screen.

Rachel Berger: Every child under the age of 13 gets five questions answered by the primary nurse. You don't ask them directly of the patient. They are by observation. And these are based on a validated screen developed in the Netherlands. We've had over 100,000 children that have been screened. This improves our ability to detect abuse.

Rachel Berger: They have a similar type of, we call it trigger system, but they have to, because of the way their electronic health record is, the system is designed to do what we call natural language processing. It actually reads parts of the notes and what the nurses document, and it pulls certain words and recognizes that you should alert a physician. For example, if a chief complaint is this infant comes in with bruising, it understands the word bruise, it knows the child is under a year, it sets up a trigger.

Rachel Berger: Those are the ways in the general EDs that we recognize abuse. They get a very similar alert. They have a very similar, we call order set, except that their order set, which was developed by their ED directors, focuses on when the children need to come to our hospital, when they can treat them there, and then what tests to do. The expectations are different because they won't admit children to their hospitals, so their focus is more on what a general ED might do.

Stephanie Dewar: I'm curious, in both of those situations, is there also support into the mandatory reporting part of that piece?

Rachel Berger: Right. That's a really important part of it. As part of this project, we recognized that the general EDs had actually no way to track whether they were making reports to Child Protective Services. At Children's Hospital, we actually scan in the actual report, so you can always look and see the reports. But the other hospitals, the general EDs, actually had no way to do it. So part of this was, how do we actually even know that it's being reported and what information they're providing to Child Protective Services?

Rachel Berger: We developed, it's called the Child Abuse Reporting Form. It's called the CARF. The beginning of 2016 is when we started it. These forms are filled out. They are not the report to Child Protective Services; they are internal documentation.

Rachel Berger: On that form, it actually teaches the physician what... It has checkboxes. You need to say what kind of abuse you're worried about. What are the injuries you're worried about? Do you need to call the police? Are there other children in the house? It leads the reporter through a set of questions. It is set up so that what's on there can be pasted directly into the online reporting form in our state, so that makes it easy.

Rachel Berger: It also goes in a folder called Abuse Reporting. So actually one of the biggest benefits is not just that we can see that abuse has been reported before. The physician can see, for example, there's been three prior reports of abuse and can open up what's been reported. That's been very important because anywhere in the system that they go, whether they're going to a hospital in Hamot or Altoona or North, they can see that somebody else has reported. That's been actually very important.

Rachel Berger: Education about reporting to Child Protective Services, and we call the handoff, like how do we hand information, is actually very complicated and something that we're still working a lot on. We have a lot of education here at Children's as well. This is something that's very difficult.

Rachel Berger: We know the medical handoff is hard. If I'm leaving at 5:00 and I'm handing you my patient, there is lots of research about what the best way to do that is. There is almost nothing that we know about the best way to make that handoff between a medical professional and a Child Protective Services professional who has no background medical knowledge at all and doesn't know that fracture is the same as a broken bone. They don't have that knowledge, and we often give them very complicated knowledge. So it's something we're hoping to work on more in the next few years.

John Williams: That was something that you just mentioned, Dr. Berger, that when I was working as an emergency room physician years ago, I think a common misconception I encountered that maybe you could touch on, a lot of people think you have to know or prove that abuse is present to make a report. But that's not the case, is it?

Rachel Berger: No. In fact, I would say that if you know it's abuse, that's already too late, right? What we want is to... The requirement is to report when you have reasonable suspicion for abuse. Now, that's a complicated term, because for everybody, reasonable suspicion might be a little bit different. And that's a whole area of research is how people define reasonable suspicion.

Rachel Berger: But we say to people, if you think abuse is possible, not that it's the last thing on your differential of 18 things, but if you think it's a reasonable concern, you need to report it. Children are protected, we hope, by multiple people raising concerns about abuse. So we certainly don't want people to only report when they're sure it's abuse. It's like only taking a child to the operating room when you know they have appendicitis. You've got to take quite a few children who

don't have appendicitis to make sure you catch all the ones who do. It's the same way with abuse.

Rachel Berger: When we do see children, one of the big areas of research is missed abuse. We know, for example, with abusive head trauma, which we were talking about earlier, shaken baby, at least a third of those children who are diagnosed with abusive head trauma have been seen by medical professionals before for, in hindsight, what clearly was child abuse, but was missed. We know that many times we see children here, as well, who have injuries; they have evidence of old fractures, they have multiple prior emergency room visits. So if we wait until we're sure, then we've probably missed other opportunities.

John Williams: I love the idea of the systematic approach to help me do the right thing and to have these popups. I'm wondering, how can we ensure the physicians do it? Because we all have these alerts pop up all the time, and frankly, my instinct when any alert pops up on any computer anywhere is to hit delete or escape. So how do we make sure that people don't do that?

Rachel Berger: Alert fatigue is clearly an issue. It's actually more of an issue, interestingly, in our adult or general EDs because children in general are healthy children, so they don't have kidney failure or hypertension. They don't have multiple medication allergies because they've never gotten a medication, for example. So we actually have less alert fatigue that we see here than we do at our general EDs.

Rachel Berger: There's no easy way to respond to this except to say to create a system that is as accurate as you can, as sensitive as you can, but recognize that in order to get a high sensitivity, so picking up all the children who might be abused, you're going to lose specificity. There are going to be children that alert that don't have child abuse.

Rachel Berger: And the bounce for each disease is quite different. For example, a suicide screen, you really don't want to miss anybody, so you're going to have to be willing to take quite a few false positives, even though you would say, well, that could contribute to alert fatigue. If I'm screening for a child who needs somebody to come and play with them in the play room, I probably am not willing to take too many extra alerts.

Rachel Berger: I think, as a system, we need to look at all the alerts we have, make sure that we're bouncing the need for sensitivity with this concern of alert fatigue.

Stephanie Dewar: Dr. Berger, this is an interesting part of pediatric care that I think probably most people don't think about and recognize that there are experts like you that spent a lot of time and energy on this unfortunate experience that some children and families have. I'm just wondering what joy or satisfaction comes to you from interacting with patients and families in this way.

Rachel Berger: I think you're right. I think people don't recognize really how common child abuse is, unfortunately or fortunately, I guess. I think people who do child abuse as a full-time job, and our hospital, we have four full-time child abuse pediatricians and two others that are part-time, we do it because we really sometimes see that children's lives are changed by what we do.

Rachel Berger: And we do deal with a lot of unhappy families. We deal with a lot of complaints from families. But I think as a group, and as a group of child abuse pediatricians, our focus is always on the child, and we worry much less about whether parents like us for what we do, and really focus on the child and making sure in the end... We know when we do what we do, we start a very painful process. If I report to Child Protective Services, I know that I am causing pain to that family. As a human and as a pediatrician, that's a very hard thing to do, but we do what we do because in your heart, you hope that at the end of that process, the child and the family come out as a stronger unit and that you've really helped that family.

Rachel Berger: But I think if you only looked at the beginning of the process, which is actually what a lot of emergency room physicians see, they only see the beginning, that's the hardest part, because that's when you're causing the pain. But over time, when we see children back, some children who were starving and now come back and they're fed, they're doing wonderfully, they're in school, and you realize that for that child, what you did really saved their life. And you don't need that to happen too many times, really, to keep you going.

John Williams: Well, Dr. Berger, I really want to thank you for joining us here for this discussion. It's been really exciting for Dr. Dewar and I to hear about the work your team is doing. I think it's a beautiful example of National Institutes of Health Research money funding research like yours that changes the way that we take care of these kids to protect more children.

John Williams: Thanks, everyone, for listening, and we'll talk to you next time.