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NATIONAL CENTER FOR HEARING ASSESSMENT AND MANAGEMENT
CONGENITAL CYTOMEGALOVIRUS FROM PREVENTION TO TREATMENT-WEBINAR
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>>> Get infected during pregnancy are asymptomatic at birth. There is no reason it suspect that they have this infection. And even babies who have symptoms as I alluded to previously, the symptoms can be nonspecific.
And another challenge is that in most instances you need to test for congenital CMV within a few weeks of the baby being born and so often you can't go back and definitively diagnose congenital CMV.
Although I will say more about that later because there are cases where if there is a dry blood spot available from newborn screening that some sometimes that can be used to get a definitive diagnosis.
But because of these reasons, often if a child has some developmental problems or other related illness, you really can't be sure that it was caused by congenital CMV.
Now getting at the biology, what happens is CMV, cytomegalovirus is a member of the herpesvirus family, like these other herpesvirus or the herpes simplex viruses that can cause cold sores, you have this primary infection that happens.
Then the immune system controls the virus and mostly you don't have symptoms.
But later on somebody who had chicken box could develop shingles or somebody with a cold sore, it will reactivate and so CMV is

like these other herpesviruses that you can have a reactivation, but you can also have a reinfection with a different strain and these latter to items here if you can seat green arrow, they are sometimes call recurrent infection or secondary infection or often they will be called non-primary infection to distinguish them from the initial infection over here.
Now to help you understand the rest of the slide, if you don't have a laboratory background, I wanted to provide you some of the vocabulary that can make some of the other results plainer.
If you want to measure whether someone has ever been infected with CMV, that is called sometimes called seropositivity or you will hear the term seroprevalence.
What it detects is antibodies so it doesn't detect -- you return detecting the virus itself, but you are detecting the immune response to the virus.
There are different ways this can be tested.
One of the most common you might see the test formats called an ELISA.
If you want to know if someone is at risk for transmission or sometimes that's called shedding or excreting the virus and that -- to do that you need to detect virus or viral DNA.
The way that is done is using PCR or culture.
These things can help you if you want to know have you ever had it, you would use an antibody test.
You would test for seropositivity.
If you want to know someone is at risk of giving the virus to someone else or if you want to diagnose a baby, you would use this second kind of test for the virus itself.
Okay, so now that we are familiar with the terms, I wanted to talk about seroprevalence.
That means the prevalence of people who have ever been infected.
Of course, that goes up over time because it's cumulative.
And what you can see from this slide is on the X axis we have age going from children up to people in their 40s.
On the other axis we have the prevalence of CMV infection whether someone has ever been infected.
And you can see in young children -- now, these are different racial ethnic categories and here we have Mexican-American, non-Hispanic, blacks and non-Hispanic whites.
You can see that those are different that seroprevalence is higher in Mexican-Americans and then next in non-Hispanic blacks and lowest in non-Hispanic whites.
Over time it goes up and you also can see in some of these risk groups, actually in all of them it starts to get higher for females if you compare non-Hispanic black females to

non-Hispanic black males you see differences there and the same thing in the other groups.
So that kind of gives you an idea of who is infected, when they become infected and how that changes over time.
Now if you want to know, well what if you looked at a group of people who never been infected?
So in the previous slide was just looking at cumulative measure of whether someone has ever been infected.
If you wanted to look and take a group that never been infected and follow them up over time and see how frequent new infections are, that's what's called seroconversion or sometimes seroincidence.
What you can see from this figure is on the Y axis the number of CMV infections per 100 people who are susceptible and never been infected per year and this will be one per 100 per year or 1% per year.
And then it's broken down by race ethnicity, by socioeconomic status and region.
And the takeaway from this are that for new infections you are seeing a higher rates in non-Hispanic blacks and Mexican-Americans.
Closer to five or 6% per year compared to one and a half% for non-his -- one and a half percent for non-Hispanic whites.
You see a difference by SES has higher rates of new infection compared to middle or higher SES.
And this starts to give some clues about whether how do people become infected.
Here is another clue.
So if you look at children who -- so we did a study of children and we looked to see if their older sibling had CMV and if their mother had CMV and what you can see and I think I actually misstated it in the bullet, but the children who have an infected sibling have a much higher prevalence of CMV infection themselves.
So they are 30 to 50 percentage points higher prevalence if they have an infected sibling compared to other children who don't have infected older siblings.
And a similar pattern with their mothers.
If their mother is positive for CMV, they are much more likely to have it themselves than if their mother is negative for CMV.
So this provides another clue that transmission between family members is a distinct possibility.
I will show you more data that shows it's an important mode of transmission.
So what this is, this table shows seroconversions.

What happens if you follow people who never been infected and you look and see how many infections do they get over time.
So it gives you a rate.
And this is a summary.
It's from a literature review of dozens of studies and it combines the groups in the studies according to their different risks.
If you look at just pregnant women, you can see that about 2.2% per year become infected.
So that's 2 per 100 every year on average and you see similar rates if you look at studies of parents who have children who aren't shedding CMV.
So they don't have CMV in their body fluids.
If you look at health care workers including those who care for children in the NIKU, so who definitely would have exposure to CMV, the rates aren't much different.
However, if you move to day care providers, the rates of infection go up about three fold and also if you look at women who are attending sexually transmitted disease clinics you see higher rates of seroconversion.
And then you see your highest rates among children who have a child who is shedding CMV.
So it really indicates that children with CMV infection are at high -- are important source of infection, but exposure -- if you have exposure to sexual risk factors that's also important.
And it's worth pointing out that even though these rates are fairly high, that only one in four parents catches CMV from their child who is shedding.
You can put that in perspective if you think about if you had a child who had a cold that lasted all year and you only had one in four chance of getting infected.
That seems unlikely for a cold.
But for CMV, that's about what we see.
Once again, if we compare these are mathematical models.
If you compare how contagious.
You can think about it as how contagious it is comparing CMV to these other infections.
And parameter that gets used is called the force of infection and basically you can think about if you had 100 uninfected people about how many would get infected over the course of the year.
Again, these aren't strictly comparable because of age differences.
You get the general idea that measles, mumps and rubella more infectious, varicella is kind of in between and then the studies

of CMV fall in the middle and then if you look at herpes simplex virus type 2 which is exclusively sexually transmitted you get a lower rate which -- so these things might imply that CMV isn't getting transmitted through the air the way measles, mumps and rubella can, but it gets transmitted perhaps in additional ways besides sexual transmission when you compare it to herpes simplex virus type 2 and if you compare it to hepatitis A which I believe primarily food-borne and hepatitis B which is primarily blood transmission, you can see that CMV is more easily transmitted than these infections.
Now we were going to move, moving from seroprevalence or seropositivity to shedding or excretions.
These are date thaw help you understand who is at risk of transmitting the virus to other people because they shed it in their bodily fluids.
And I hope it's clear enough here but these dots come from individual studies so each dot is an individual study or group within a study.
So this figure represents a literature review of dozens of studies.
And what you can see -- I will point out a couple of things is on the Y axis we have the percent that have shedding and then the different risk groups on the X axis.
I want to point out if you go to healthy children who are in day care you see this higher median of about 23% of them are shedding CMV.
So it's very common in healthy children so it's not just children with congenital CMV who go on to shed when they get older.
It's healthy children.
So very common.
If you look at children who are not in day care centers, you still see a lot of shedding, about 12% median but clearly exposure to other children in day care settings seems to be a risk factor.
And let me point out the adults here.
Adults who don't seem to have particular risk factors, they also can shed but their median is lower whereas adults with specific risk factors such as having a child who is infected or attending an STD clinic they have higher rates of shedding.
Same sort of idea, but let's look at it by age among children.
Each of these lines -- now some of them are hard to pick out.
But if you follow the lines, they show the prevalence of shedding by age.
And so it's mostly children under five.

And in this literature review we broken out a lot of the studies have been done at Alabama, University of Alabama Birmingham so we separated those out.
Basic idea if you look at panel B and panel C is that you can see -- let me see if I can follow one of these that shedding prevalence is low in the very youngest children and then it tends to go up in the one to two range and then it seems to drop back down in the older children and again these trends aren't perfect and they give you a basic idea that indicate that if you are think being how CMV is getting transmitted, it's more likely that exposure to a younger child is going to put you at risk as compared to exposure to an older child.
Now this slide, I just want you to remember, is the children who is shedding which is 50 to 20% whereas this next slide will show you the viral load.
This says if you have somebody who is infected, how much, what quantity of virus is in their fluids.
And these are unpublished data.
These aren't robust because they come from one study.
And are more tentative but they give you a basic idea.
The place I want to start is let's start over on the right.
Basically what this says is this Y axis is the viral load.
This shows that each dot is a measurement from a child.
It suggests that you on average have higher viral loads in saliva than you have in urine.
If you move over here, I will have you focus on this panel A, what this shows is that as you get older your viral load, if you are a child who is shedding, tends to kind of go down.
So the children who are youngest seem to shed at the highest viral loads.
So that's point number two.
And point number three, and there is fewer data on this, but just so you can compare, if you look at viral loads in young children in the saliva of young children and compare them to their mothers-- there are a few data points, but we did see a significant difference.
This implies that if it's probably easier to catch CMV from a young child than an adult and it's probably easier to catch CMV if you are exposed to saliva than if you are exposed to urine.
So summarize and this schematic puts things in the context of a pregnant woman, is that you really need direct contact with bodily fluids.
You are not going to get CMV by sharing an elevator or shaking hands with someone for the most part.
There doesn't seem to be evidence of that.

Saliva and urine appear to be important fluids for transmission.
And as I said, in most cases the highest viral loads are in saliva and young children appear to be a major source of infection.
However, CMV appears to be transmissible through intimate adult contact such as sex or kissing.
So this slide here is just to make you panic.
But I'm going to walk you through it.
And I wanted to show it to you because it gives you kind of the big picture of the epidemiology of congenital CMV infection.
I will show it to you twice.
The first time just to give you a sense of who gets infected.
And the second time -- and who gets disease.
And the second time I will talk about intervention, what interventions appear to have some potential benefit.
So these numbers are from the U.S. census.
I forget what year A few years ago.
About 4 million live births and you can see that the best estimates -- again, these numbers are -- there are some -- there are approximate.
They are not especially precise but they are as close as we can get with all of the data in the literature so far.
So in the U.S. maybe about a little less than 1% of children are born with congenital CMV infection.
So maybe 25,000, 30,000 children.
And we are kind of ignore this group over here.
The uninfected children.
If we look at these 25,000 children, a little more than 10% of them will seem to be sick when they are born.
So that's this group here.
Maybe a little over 3,000 will be sick when they are born.
However -- well, let me point to what I really want to emphasize here, I will skip these groups here and talk about them later.
As far as hearing loss goes, you will see that about 815 and plus 670 and a bunch of these other children will have hearing loss.
So some of them will -- this will happen when they are born and some of them will be delayed.
And if you go over here to the children who are asymptomatic at birth, most of them won't have hearing loss but if you add up these groups here, about maybe 10 to 15% will develop hearing -- I'm sorry.
About 5% will have hearing loss at birth and then maybe another 5 or 6% will develop hearing loss later on.
That's kind of the basic epidemiology.

It suggests where you might intervene and it also suggests some of the issues surrounding intervention.
And I will talk about the more explicitly when I show this slide again.
Let me point out that this hearing loss, the way it's been measured in the literature for CMV, some of it is less severy.
Some -- severe.
Some is unilateral and 70% is unilateral and/or mild bilateral.
It's not all severe or profound.
This is the basic epidemiology and I hope it's not too complex but you refer back to it if you have questions and I will show it to you again and talk through more of the issues on this slide.
Just to give you an idea, kind of the classic study from Alabama Birmingham that really lets us understand when hearing loss occurs, you can see -- what they did and these are hundreds of children with congenital CMV or maybe more than that followed over time and you can see the cumulative hearing loss.
There is a big chunk of that that happens right at birth.
So you can't really see but of the symptomatic kids, about 15% have hearing loss right at birth and then you can see a number of, a percentage develop it later on.
And also if you go down to these asymptomatic children there is a much smaller, it's blocked but about 5% have hearing loss at birth and then another 5 to 6% will develop it over time.
So again these if you go over to the right, these are the children that aren't getting detected with the universal newborn hearing screening.
Now this is kind of a different way of thinking about it which shows that if you looked at all of the children who have hearing loss, how much of that can be attributed to CMV, congenital CMV?
These estimates are a little bit imprecise.
These are the best storm systems that about one in five of children with hearing loss have it because of congenital CMV.
So the takeaway points.
This one might have been obscured a little bit but in a previous slide the slide with all of the boxes, the flow charts, non-primary -- well, maybe there is another slide come to think about it.
Non-primary maternal infection is an important source of congenital infection.
It's not just the primary infection that you have to be concerned about during pregnancy.
As I said before, about half percent or 1% of newborns are infected and of those you have some range of disability

occurring at birth or developing in about perhaps 15 to 20% of these children.
And congenital CMV is a major attributing cause of childhood hearing loss.
So I'm going to shift gears a little bit.
And talk about how -- what can you do about this?
What can be done?
And some of these I'm not going to say quite as much about.
I will try to give you a preview and then as I said, I will give you resources later on.
So vaccination will be the ideal intervention.
There is not currently a licensed vaccine, a number of vaccines are in clinical trials.
It's a really tough nut to crack and it doesn't look like we will have a licensed vaccine in the near horizon.
Anyway, that's a really important area of research.
Prenatal screening is something that gets debated and is not typically done in the United States.
Is it done in several European countries, more routinely but I'm not going to go into details there.
I do want to say a little bit more about the behavioral intervention and that's kind of the thing that I have been researching more lately.
And if you go to the CMV conference in Salt Lake, you will get an earful of that from me.
I will say more about that later.
The basic idea is that if you are exposed to young children during your pregnancy, there are some specific steps you can take to reduce those exposures.
We typically tell women that the three things to particularly pay attention to are when you are kissing a young child to avoid saliva by kidding them on the forehead or cheek.
Number two, is to avoid sharing food and drink and utensils with your young child.
So -- or a pacifier, cleaning a pacifier in your mouth.
Basically if it's just been in your child's mouth, you don't want to put it in your mouth.
That's the second behavior.
The third behavior is if you get urine or saliva on your hands or think you might have to wash them or if you don't have soap and water to use a hand sanitizer.
Those are the big three things.
If you are around young children a lot, it's not easy to get CMV.
So there is no need to panic.

There is some common sense things you can do to keep those fluids from getting in your eyes, nose or mouth.
We also talk about if you have sexual partners, we encourage people to reduce their exposures by not having new sex partners or by limiting new sex partners during pregnancy.
So those are kind of the behavioral ideas and studies have been done and are ongoing to see what approaches to those messages are more effective in changing behavior and so on.
So it's an exciting area of research.
Moving on, there are some potential treatments to prevent fetal infection or fetal disease and I will kind of sum them up.
One of them is to use hyper immune globulins especially those that are specific to CMV.
And the data on those are ambiguous.
It's not clear whether this treatment prevents fetal infection or prevents fetal disease.
So it's definitely gets done in certain situations and there may be some benefit, but it's kind of a controversial area in the scientific field.
And then the other approach that hasn't been studied as much is to use antiviral treatment.
Especially an antiviral drug called valganciclovir.
So that's under study.
There is no clear evidence that it is effective.
So those are kind of things to do during pregnancy.
I will focus now more on the newborn screening for CMV and early detection and intervention.
I want to point out that really none of these interventions is routine in the U.S.
So even though there is some approaches and some research being done or some pilot work being done particularly in Utah related to newborn CMV screening, in general these interventions are not done.
That might be unfortunate.
It's an opportunity but it also shows the science is really in a spot where we are trying to figure out what really will be beneficial and what isn't beneficial and also assessing not only benefits but risks as well.
So as far as -- I would say here universal newborn CMV screening.
There is reason to believe and this is what's being done in Utah currently.
It is that children who failed their newborn hearing screening are being tested for CMV as well.
That's really what's called a targeted newborn screening rather

than universal.
And it's more likely that the benefits are higher and the risks are lower for this targeted screening currently.
And that the evidence relating to universal screening requires more work to assemble and assess.
But if you think about the typical ways that screening programs are assessed and in particular newborn screening, there is often criteria that get used to determine is this good public health policy.
CMV probably satisfied several of those.
As far as being an important health problem, it has recognizable latent or early symptomatic stage and although we don't know everything about the natural history, we know quite a lot.
Now there are a number of items that may not yet be satisfied.
There are very good tests for CMV.
So the issue isn't that we don't have good tests.
The issue is that we don't necessarily have tests that are really cheap, really easy, or that could be fit into the current newborn dried blood spot program.
Just feasibility and cost and cheapness are issues that are being addressed for CMV tests.
There is some evidence that tests can be acceptable to the population.
I will show you a little bit of data on that.
There is perhaps some ideas as to who to treat and how but that's still debated.
And this is probably an issue with all universal screening for different conditions.
Are there facilities available for diagnosis and treatment and if these interventions are effective, are they cost effective.
So I'm going to talk about briefly a few slides about these and then I will wrap up.
So just to give you an idea of what's specimen would you use for newborn screening and what type of and how it might fit in, the three specimens that have been considered are dried blood spots, saliva and urine.
And for all of those, for the most part the method for detecting them the most feasible method is PCR.
The advantages for dried blood spots and this is a huge advantage is that there is already a very well developed program in every state for dried blood spot screening and the state health departments administer it and really have this important infrastructure and makes it possible and makes follow-up much easier as those of you who work on newborn hearing screening know that the many difficulties that follow up because of the

nature of that screening program.
The big disadvantage for dried blood spots is really -- is biological.
That CMV viral load is just lower in blood than in saliva and urine.
And it's hard to get as much blood out of a blood spot and there is usually less available because it's used for other things.
So that's a real challenge and some children who have congenital CMV are going to be missed if you are using dried blood spots.
The question is, will -- are the ones that are missed unlikely to develop disease anyway?
That's possibly true or at least true for some of them.
But that's the big disadvantage for dried blood spots.
For saliva and urine, the advantages and disadvantages are similar.
You get typically very high viral loads in those specimens.
Typically hundreds or thousands or more times as much virus in those specimens than in blood.
And it's easier to get more of the specimen if you do collect it.
The big disadvantage is that that sort of collection isn't part of an existing newborn screening program.
Some ideas about this might be to include saliva collection as part of newborn hearing screening.
Another idea that's been proposed is perhaps putting saliva or urine on to filter papers that could be processed in the same system as dried blood spots.
There is different ideas and approaches that could be promising.
But they are still in the developmental and research stage for the most part.
Just to give you an idea about well, what sort of treatment can be done.
There is really two approaches.
One is pharmaceutical and one is non-pharmaceutical.
The evidence for pharmaceutical treatment primarily comes from a single study.
Although there is a second study that has enrollment has been completed but those data are not yet published.
But the basic idea was that children who were in general very sick who had central nervous system deficits were randomized for treatment with this IV antiviral drug called ganciclovir those who received the treatment were less likely to experience worsening in hearing loss and they seemed to have somewhat better developmental outcomes.
But they did have significant neutropenia often.

In the follow up study, the data that used an oral drug which would be much better as far as side effects and feasibility and they also included children who don't necessarily have central nervous system deficits.
So there is some evidence that antiviral treatment could help.
It has potential for important adverse effects and it has really only been studied in very severely affected children.
Okay, so I'm back to this spaghetti here.
And what I wanted to point out is that there is some evidence that if you had early detection and intervention for CMV, you could help some children who aren't currently being helped.
So in other words if you did universal screening for CMV, there is evidence that suggests that it could be beneficial.
Let me point you to we will start out with these symptomatic children who aren't diagnosed clinically.
So there is a big group who here who are just sick enough they will get diagnosed by their doctor.
They will get tested.
There is a big group that may have jaundice or an enlarged liver but don't seem really sick and maybe they don't get diagnosed.
They don't get tested for CMV and they don't get diagnosed.
For these children some of them will have hearing loss at birth and those will get detected through universal newborn hearing screening.
But then some of them will have delayed hearing loss as well.
And the idea is that for these with hearing loss at birth, if you know that it's caused by CMV, you may consider treating them with antiviral drugs.
Now we don't really have evidence of treating older children with antiviral drugs, but there is evidence that if you identify these children early so if you knew they were CMV positive and so you were following up and doing audiological follow up and identify their hearing loss early get them into the same early intervention that you would for these children that have hearing loss at birth and so there is some good evidence that you could help these children.
The same sort of evidence that you can help children who have hearing loss at birth and the similar idea is up here for the asymptomatic children.
If you know they have CMV, you follow them closely and if you identify that hearing loss early, then you get them into early intervention.
And so that's the idea behind the benefit.
The potential benefits for universal newborn CMV screening.
So I'm sorry if that's a lot to throw at you, but there is some

evidence that both pharmaceutical and non-pharmaceutical intervention could be beneficial if children were screened.
I'm almost at the end so hang in there.
We do have some evidence about newborn screening the acceptability of it.
We did a survey and asked people after we gave them a brief background on CMV we said we asked them these different questions.
And if you look at the middle three, you kind of see we said not only would you want your baby tested but would you want your baby tested if the hospital didn't do it routinely?
Or if you had to pay $20 or even if you -- would you want the testing done even if your child never developed problems.
Most people said they somewhat are strongly agreed with these three middle statements.
So most people viewed screening favorably.
A minority said they thought that the problems were too rare to worry about or that they worried that the tests would lead to unneeded doctor visits and expenses.
There is ambivalence there but a general positive view of newborn CMV screening.
And just I think this may be my last slide.
But as far as future directions, it's an exciting area.
There is a lot going on.
There is a lot that really could be done that would be beneficial.
Looking at dried blood spot say as -- assays to see if there are formats or ways to do it that would be more sensitive or more effective.
Looking at tests that you could do on site for saliva or urine like a rapid strep test, if you could do a rapid CMV test in the -- when the person comes in to do the newborn hearing screening, for instance.
Looking at using filter paper for urine or saliva collection.
Looking at what are the effects on parents for screening.
What are the best protocols for follow-up for infected children.
Looking at pilot studies for how would you do universal screening and the last one is what's being done in Utah.
I think has been done and still being done in Minnesota which is targeted screening.
There are a number of real exciting approaches that are being done or planned that could really inform what's happening with newborn CMV screening.
And here are some places you could start if you want to know more about these other things that I didn't talk about as much.

I would encourage you to visit these references as a starting point or e-mail -- you could e-mail me and I could point them to you as well.
>>> Perfect, thank you, Dr. Cannon.
I'm going to put up a poll question here and that is based on today's information.
How would you rate or how would you -- how important is it to provide women information about CMV.
So if you would take a minute and answer that poll.
Then we will turn it over to the Q&A period.
The question and answer box is on the left side of your screen.
And I will field the questions to Dr. Cannon and I want to take a minute and remind you that this webinar is being recorded and the recording will be posted on infant hearing.org.
And cmv.usu.edu.
>> Great.
Thank you for answering the poll.
I will broadcast the results to the poll now.
And then we will go ahead and talk for just briefly about the upcoming CMV public health and policy conference.
The conference will be held in Salt Lake City, Utah, September 26 and 27.
And it's really a one of a kind conference that's bringing together CMV experts from around the world to discuss public policy or public health and policy issues relating to preventing, identifying and treatment of CMV.
The conference has four tracks.
Research to practice, public health implications, early intervention and family support.
And we really have sessions set up for anyone interested in CMV.
And for those of you that require continuing education units, we will be offering CME, triple-A, ASHA and in check CEUs and for more information as indicated on the slide there, please go to cmv.usu.edu and if you have questions about the conference certainly feel free to e-mail me.
My e-mail address is in the text box on the left side of the screen.
So let's go ahead and answer some of the questions that the participants are posted in the Q&A field.
Dr. Cannon, the first question is, please define PCR as it relates to CMV screening.
>> Okay.
So PCR is -- what it stands for is preliminary chain reaction.
But what you need to know about it, it was a brilliant technique developed a few decades ago that allows you to detect very small

amounts of DNA and it just amplifies them so you can detect small amounts.
And the reason it's important for newborn screening is because it's the most likely method that would be used to see whether the child's urine or saliva or blood has CMV in it.
It's also commonly -- it's becoming more commonly available even within hospitals.
Laboratories do a lot of PCR testing as well.
>>> Okay, great.
And the next question is, how soon does the newborn develop antibodies to CMV from perinatal infection?
>> So in general, I believe antibody development happens within 7 to 21 days.
I'm not really an expert in the immunologist, but that's about how long it typically takes.
>> Okay, great.
And then would you routinely recommend screening infants that are small for gestational age for CMV?
>> So an -- there is not really data on whether that would be beneficial or not.
It's probably a matter for that would be worth researching for targeted screening because children who are small for gestational age may be more likely to have CMV infection and may be more likely to be at risk of poor outcomes.
>> Great.
And if you have an older child, eight years oldish who is experiencing a decrease in their hearing, should you assume that they may be shedding the virus at that time?
>> So we don't really have data on -- you know if you are assuming you know they had congenital CMV and their hearing loss is related to CMV, it's very possible that they are shedding, but there is not very much data on older children.
Among younger children, there is more data.
The problem is that older children can be shedding even if they don't have congenital CMV.
It gets harder to tell whether it's an issue of a congenital infection or a infection that they acquired as they got older.
>> Okay.
Great.
And just as a reminder, if you have a question, please type your question in the Q&A field that's in the text box on the left hand side of your screen.
Dr. Cannon, our next question, do you see rates of shedding increase as people with CMV age?
>> So I guess it depends on -- so people who mostly adults don't

shed as much as kids.
So the broad brush is young kids shed a lot, older kids shed less, adults less.
There is some -- it's a very hot topic of research whether elderly people shed more than younger people, but I don't think the data are very good in that area.
>> Okay.
And then the next question is, do you have any ideas as to have salivary grands are such an intense site for CMV.
>> I do not.
But somebody might.
I'm the wrong person to ask.
>> Okay.
So the next is can a person who has already had CMV at some point in their life then be infected again by another strand of CMV therefore making a pregnant woman at risk around CMV if she had a strand in the past.
>> The answer is yes, absolutely.
So a pregnant woman who is CMV seropositive, so she has been infected at some point in the past, can acquire a new strain of CMV and can transmit that new strain to her fetus.
So that's why our message is, our behavioral intervention message is to really try to emphasis regardless of your CMV status to practice those behaviors to protect yourself from CMV.
>> Okay.
Great.
The next question is, I have a five-year-old with congenital cytomegalovirus.
What are the risks for me to be reinfected again.
>> We don't really have data.
There is a couple of case studies on mothers who have children with congenital CMV having another child with congenital CMV.
But what is likely to be the case is that the risk is about the same as it is for any mother who has had CMV previously.
So most often mothers are exposed to children.
There is not really evidence that being exposed to a child, an older child, let's say a five-year-old with congenital CMV is more likely to be shedding than another child who didn't have congenital CMV.
So in other words, the exposure risk is probably the same.
Just if you have a five-year-old child you have some risk.
It's probably not as high as if you had a one-year-old or two-year-old because they are going to have a lower viral load most likely.
And they are less likely to get their saliva or urine on you

compared to a one-year-old.
>> Okay, great.
And then again these are questions that people are typing in.
If this is not the mother's initial infection of CMV, then you are thinking there is no risk to her subsequent pregnancies?
>> There is some risk.
So basically if you have been infected before, you probably are less likely to have a child who has the poor outcomes.
So you are still at risk of getting reinfected and infecting your fetus, but if that happens, it's likely that the risk is lower that your infected child will have disability or more severe disability.
>> Okay.
And has newborn screening presented to the secretary advisory committee for inheritable disorders in newborn and children as a candidate condition.
>> I will tell you what I know.
My understanding was when they first developed -- when that committee first developed the sort of criteria and how they scored the different conditions, that they looked at a bunch of different things and that CMV was one of them and that it didn't reach the cutoff that they determined at that time.
I don't know that it was specifically presented the way new conditions are presented now.
I think it was just done as part of a big group of conditions that were looked at when they initially made that framework for deciding what to recommend.
I have heard of some interest in bringing it up now that there is more data than there were 10 or 15 years ago but that's about the extent of my knowledge.
>> Okay.
Great.
And I want to draw your attention to the final poll of the conference.
Are you planning on attending the CMV public health and policy conference.
If you will take a minute to answer that and we will take a few more questions and then Dr. Cannon has graciously given his -- if we do not get to all of the questions, he is willing to answer them for you or better yet we would love to see you at the public health and policy conference and there will be a lot of opportunities to learn more information about CMV as well as interact with all of the presenters of the conference.
We will take two more questions and then sign off for the afternoon.

So Dr. Cannon, what does the antiviral do for children with CMV? Does it stop the shedding?
>> So the evidence from the clinical trial is that it does reduce shedding and sometimes eliminate it.
If I recall correctly, it -- some of the children who are treated so they were treated for six weeks, that some of them or many of them return to shedding later on.
>> Okay.
And then our last question that we will take today is, if a child has hearing loss at birth, do all states require screening for CMV?
S in so right now I think 49 states do not require it.
I believe it's just Utah where that's a state law.
Maybe someone else on this call will have more information on that.
No, it's not currently to my knowledge being done as part of a state program in any other state, although there are a few places where it's being done as a research sort of item.
Or where academic institutions are collaborating with state health departments to do targeted screening.
>> Okay.
Great.
Thank you for taking the time to answer those questions.
So we will wrap up for today.
Again, Dr. Cannon is willing to answer your questions and his e-mail is indicated on the slide right now.
I did just want to remind you that the recording of the presentation will be available on infant hearing.org as well as cmv.usu.edu.
As well as the PDF version of the slide deck that Dr. Cannon presented today.
Again, we would love to see you at the CMV public health and policy conference at the end of September and for more information about the conference, please go to cmv.usu.edu or feel free to e-mail me at my e-mail address that's indicated on the left side of the screen.
So we will sign off for now and we appreciate Dr. Cannon taking time out of his busy schedule to share his invaluable knowledge about CMV with all of us and we appreciate your attendance.