

**DAVE:** Good morning. I have the pleasure of introducing Sarah Taylor who is going to speak today on opportunities in the state to reduce infant mortality. Sarah came to us after training in both North Carolina and in Miami. And she joined our residency.

And then we were really fortunate to recruit her as a fellow in neonatology. She came to us as a fellow with a plan. She was going to go back to Florida and practice clinical medicine.

But we changed her plan. And we brought her into the division as an investigator. And since that time, she has been involved in almost every aspect of neonatology that we're involved in.

She has been my go-to person for questions regarding research, as well as trying; my go-to person for clinical medicine, in terms of nutritional support; and has been an invaluable resource to the division. She is involved at a local level in multiple committees-- the neonatal nutrition committees, the cardiac nutrition committees, and parental nutrition committees.

She's involved and still working with the Epic Development Team to improve parental nutrition after her transition to Epic. And she has taken what she's done here-- and hopefully will present some of those data-- and taken it to the state through the Birth Outcomes Initiative, which is a statewide initiative sponsored jointly by the South Carolina Hospital Association, the HHS, and DHEC. And she leads essentially the nutrition segment of that group. It's baby-friendly, but it's really focused on the use of breast milk and the support of breastfeeding in women.

And then not insignificantly, after 20 years of trying, Sarah was successful in getting funding through MUSC and the HHS, as well as support from regional hospitals across the state and actually brought together everything that was necessary to start the South Carolina Mother's Milk Bank, which after the first year in existence was at least cost neutral-- so a tremendous success.

What many people don't know about Sarah is that she follows a strict timetable. And so when I asked her, what do you want me to say during my introduction, she basically said, keep it short. And I know that her presentation is timed down to the second. And so with this, I'm going to just ask you for a strong round of applause for Sarah Taylor who will be talking about opportunities in the state.

[APPLAUSE]

**SARAH** Thank you, Dave. It's wonderful to be here.

**TAYLOR:**

When I came here in residency, I was not thinking neonatology, but had two intern rotations. And in my first one, Dr. Annibale was my attending. And it was tough. I was scared. Babies died. It fits with this topic.

But I left there thinking, as awful as that circumstance that month was, I was kind of drawn to it. And I get this evaluation from Dr. Annibale. And it was very positive.

And so all of a sudden, I'm like, wow, it's really a strange place, but I'm drawn to it, and Dr. Annibale, who I have so much respect for, thought I did a great job. So I'm really thinking about this. In my next rotation, Dr. Annibale was my attending again.

So I'd go in with more confidence and excitement. And three residents sitting there-- Reed Whitehead-- this is Dr. Annibale speaking-- Reed Whitehead, I've worked with you before. I know you're a great resident. Dana Crater, we've been on call before and such. Hi, I don't know you.

Crushed. Crushed. So as I think about this, I wonder subconsciously if one reason I've stayed at MUSC these 17 years is so that Dr. Annibale doesn't forget who I am.

So this is a strange topic for me. This is not my research. This isn't even really my clinical practice, because I completely practice in the hospital. I'm going to talk a lot about things that happen after babies leave the hospital. But as we go along, I will uncover for you why I'm up here, why I volunteered and wanted to give this grand rounds talk.

I'm part of the South Carolina Birth Outcomes Initiative. This is a group of people that go to Columbia once a month and meet on ways we can make our health of our mothers and our babies better. And it's not only to improve those health outcomes, but we've tied it to cost. And that's one way to get the right people in the room is to tie it to not only are we going to improve outcomes, but we're going to make sure that it's done in a cost-effective way.

And we've been doing this-- the group's been meeting since 2011. And we have the right people in the room. And I learned so much.

One of the first meetings that I attended, they kept talking about LARCs, LARCs. And I'm sitting there thinking, what are LARCs? I do not remember that term in medical school. So fortunately, with a smart phone, you can discreetly, under the table, what is LARC? And it is Long Acting Reversible Contraception.

So oh, now that makes sense why we're talking about this at a birth outcomes. And what they were discussing and what we've done is made it-- Medicaid will cover the placement of LARCs in that birth hospitalization. If a mother says, I don't want to have another child quite yet, I would like to have contraception-- that can be covered in the hospital instead of waiting till mom misses her six week appointment for that discussion of contraception.

And we know that when you increase the time between births, you decrease the likelihood that that second baby is going to be premature. So this is fantastic. We're doing things to decrease prematurity, and we're doing them with the support of the insurers, the payers, so that this can really happen and be of benefit, if that's what mother desires.

So that's who Birth Outcomes Initiative. These are the players involved in it. And those are the kind of changes we're making.

And with that-- with covering all of the health of mothers and babies in the state, of course we talk about infant mortality. And this is an article that came out in the *Post and Courier* back in 2015-- "Cradle of Shame"-- why are so many South Carolina infants dying at third world rates? And of course, when you're part of something called Birth Outcomes Initiative, this hurts.

We're having to come face to face with we're still not providing to South Carolina mothers and babies what they deserve-- the fact that living in the United States of America, you should not be dying at third world rates. And you see here, we have disparities in this. This is infant mortality.

The very light gray are those counties that are below the state average. And the very dark are the counties above the state average. And you see that we're taking care of the babies.

We're having decreased mortality there along the coast. But then as soon as we move west into that 95 corridor-- the I-95 corridor, it's often called-- where there is such high rates of poor outcomes for mothers and babies-- when we move there, those are the counties that are having the most infant mortality. So we really have to reach the whole state. And that's what we're working on through Birth Outcomes.

We don't need to just make Charleston and Greenville and Columbia and Florence-- the big cities-- strong. We need to make sure it is reaching every single county in South Carolina.

So what are we doing? Well, despite the fact that our infant mortality remains high, we have seen wonderful improvements. And you see here-- this is DHEC data-- that in 2011 to 2015-- and of course, with the BOI, we love that. Those are the years at the BOI-- we have continued to see a steady decrease in infant mortality when you group into those four years. So we were well above nine and honestly have been above 10 per 1,000.

And we've gotten down to a four-year average of 7.1. And really, if you look at the years divided out and kind of run down that list-- the number of live births, the number of infant deaths, and then the calculated infant mortality rate-- looking at from 2011, 7.4, 7.6, 6.9-- the first time ever we've been lower than seven in South Carolina. And then when we got down to 6.5, we celebrated that.

We walked around going, this is a great year to be born in South Carolina-- lowest infant mortality rate ever. But then, as happens, 2015 comes around. We're waiting on this data. We know it's going to be better. And we're back up to seven per 1,000 for infant mortality. So always more and more work to do, more we can do to improve our outcomes.

So what is going on? Well, we do look at it by state and compare ourselves to those other states that live with us in the worst outcomes. We're ranked 45th to 50th in anything that's good, and we're ranked 1 to 5 in anything that's bad.

So those are states that kind of live there with us. When you say, thank goodness for Alabama and Mississippi, I'm sure they say the same for South Carolina. And we do have a racial disparity.

So in South Carolina back in 2012, the rate was 5.3 for white, 12.5 for black. We improved that in 2013, 2014, narrowing that gap somewhat, having some better outcomes for our black mother and babies, compared to other states with the same racial composition. But still, 2015, we're back up to a rate of 11.6 for our black infants.

And this graph here shows how large this disparity is. And this should not be there. I cannot think of any physiologic reason that we can't fix this.

And so this is where we really, really need to be concentrating. There just cannot be this kind of racial disparity in our health outcomes, which is why, again, we're meeting on a monthly base in Columbia.

And then why are our babies dying? Well, the top four leading causes of death were the same for 2014, 2015. And they were disorders related to short gestation or low birth weight, congenital defect, accidents, and sudden infant death syndrome. So those are consistently the top four leading causes of death in South Carolina.

So what are we doing? And what can we do more? We do work with the March of Dimes. March of Dimes is there with us at Birth Outcomes Initiative.

And we know that the best way to prevent dying from being premature is to not be born premature. And so try to keep these pregnancies going longer. We don't do that too well.

March of Dimes gives a grade. And we made a D. D is bad. F is worse. But there are states who have A's, B's, and C's.

And there's our preterm birth rate at 11%. And again, there's a racial disparity there. You see how the black infants-- 14.1 is the percent of black babies that are born preterm versus being closer to nine to 10 in other racial and ethnic groups. So, so much that we can continue to do here to decrease the rate of prematurity.

What about our very low birth weight infants? What if you're born preterm? So this graph is courtesy of Dr. Annibale. And if you know Dr. Annibale, this is how his brain works.

I'm going to walk you through this, because there's a lot of lines, but there's such great information here. So I want to call your attention first to the red line, the peach line, and the green line. Those lines represent Vermont Oxford data.

Vermont Oxford Network is a network of many, many NICUs and level 2 nurseries. And we all send our data, our outcomes, to a central office. And then they help us to see where we rank, where we are on different outcomes, compared to other NICUs and level 2's, mostly in North America, but really international.

And so they set then for-- this is mortality. Deaths per 1,000 live births-- they set an average. So that peach line is the 50th percentile-- the average for hospitals NICUs, as to their low birth weight, infant mortality. And very low birth weight are babies born less than 15 grams, or about three pounds, three ounces.

And you see South Carolina data then. Well, I should say, the red line is the 70 percentile. So if you're above that, that means you're in the worst quarter regarding infant mortality. You have more babies dying. If you're below the green, then you you're in the top 25 or 25th percent of infant outcomes-- of decreasing mortality, lower mortality.

And then the blue line is South Carolina DHEC data. Now South Carolina DHEC data is a little different from Vermont Oxford data, because Vermont Oxford data is the report from NICUs. So a baby has to survive-- say they're born outside the NICU.

They have to survive to make it to the NICU for us to count that in our Vermont Oxford data, whereas DHEC data is going to be all live births, even if a baby was born away from the NICU and died before they could get to the NICU. So looking at the blue data-- that line-- that is DHEC.

And then Dr. Annibale, Dr. Southgate, and all the other NICUs in South Carolina, five regional perinatal centers, as well as level 2 centers, in 2002 came together and said, we are going to be the South Carolina neonatal medicine consortium, because we know our outcomes in South Carolina need a lot of work. We also know that there's evidence out there. There is information that we could be bringing into our NICUs.

But it's hard. It's hard to do it on your own. But if we all work together and say, you work on a respiratory project, and you're working on an infection project-- or if we notice that McLeod has a very low infection rate but MUSC's is really ugly, what can MUSC learn from McLeod? So we're looking at the evidence and the experience.

And so that started in 2002. And then we also started-- they had the foresight to go to Vermont Oxford and say, we want to be viewed as a state. We want Vermont Oxford-- we went to have state outcome data so we know how we're doing in South Carolina. So that's the black line.

And you see here that in South Carolina, less very low birth weight babies are dying. You followed that blue line and you followed the black line and see that go below the peach line. So we're actually below the national average quite often. And it had been, even with the DHEC data and the loss of life from being born very low birth weight. So that is exciting and very much points to what has been accomplished by this consortium-- the whole state coming together to improve outcomes.

And then taking it the next step, what Dr. Annibale has done here is-- because all infant mortality has decreased nationwide. So we looked at what are the decreases expected, based on national data? And we looked at where South Carolina had actually done better, where we had improvement at a faster rate in decreasing infant mortality.

And so you see there from 2002, the red line is all babies who-- we call them saves-- so all the babies saved, because we had decreased our infant mortality rate. And the blue line are the babies above that expected improvement. So to summarize all of this data, we now are looking at all of these years since 2002.

Can think of it as 450 South Carolina babies-- very low birth weight babies-- are alive because of that decreasing mortality rate-- so associated with that decreasing mortality rate. But even more exciting is because we've come together as a state-- because we have improved faster than the rest of the country, it looks like about 250 babies saved from that. And I just wonder, who are these 250 babies sitting in school today who are there because of the great work led by Dr. Annibale, Dr. Southgate, and these other NICUs across the state?

So after prematurity, then birth defects are one of the big reasons that unfortunately South Carolina babies die. And there is an increase-- almost a 30% increase in birth defect deaths from 2014 to 2015. So that catches your attention as something we need to look at.

And the most substantial increases were in neural tube defects and critical congenital heart disease. So regarding neural tube defects and what we can do, what we need to concentrate on, it still comes back to good old folic acid, from what I can tell. The March of Dimes continues to have a campaign on that-- the pre-pregnancy and pregnancy amounts of folic acid that are needed.

And finally, I'm showing you some actual evidence. So I have this wonderful meta analysis over here that was published in 2010. And for people here who really like evidence-based medicine, this is actually a meta analysis of meta analyses, which is about as good as it gets.

And so looking at these different meta analyzes-- a meta analysis of those-- you see there that consistently, it's about a 43% or so-- sometimes a little lower-- percent decrease in neural tube defects with this intake of maternal folic acid. And they've looked at the quality of the studies. They've looked at whether it's middle income countries or low income countries.

And consistently, we're seeing this kind of decrease in neural tube defects-- about 44% or so-- with the intake of folic acid. So do not forget, as pediatricians, talk to your teenage patients about, hey, someday, you're probably going to want to have a baby, go ahead and be thinking about the folic acid you want to be on, as well as when you have a mom who you know is going to be planning to have more babies-- great opportunity to talk to her also about continuing her folic acid intake.

Congenital heart disease-- I want to thank Sinay Sebluski and her team-- this is from a poster from Cathy Seachrist-- for sharing this data on the work they're doing to help us identify patients with critical congenital heart disease. So the South Carolina on your left is looking at the cases of congenital heart disease. And you see there that where the population is, is where we see more of the cases.

So 10 to 12 cases-- that's the very bright orange-- are seen in the bigger population zones and then decreasing in the number of cases. It is critical-- I guess that's kind of a play on words-- critical in critical congenital heart disease to get these babies in prenatally. These babies are born at MUSC, and they go from delivery directly to our pediatric cardiology intensive care unit.

Their outcomes-- their ability for us to intervene and make their road more stable, have them have the best outcome they can have is going to be so much easier, as well as, you can imagine, that having that information before you deliver. Letting the family prepare, letting Dr. Sebluski and her team talk to the family and educate them on what to expect in those first years especially is a wonderful way to really not shock them, not surprise them with this right at the time of delivery. So very important that if we can diagnose this prenatally, that we do so.

And what Dr. Sebluski and her team found were that the South Carolina over on your right is looking at the cases per capita-- so this is looking based on the population, where the cases were that were diagnosed postnatally instead of prenatally. So we don't want to diagnose postnatally if we can diagnose prenatally.

And you see there that it's not in the big population centers. The big population centers are actually getting to-- those patients are getting to maternal fetal medicine. They're getting prenatal echos. They're being diagnosed prenatally.

It's outside. And they actually did the math. And if you're within 50 miles of a maternal fetal medicine center, you are more likely to be diagnosed prenatally than after birth.

So we've got to reach all of these babies. It shouldn't rely on how close you are to a maternal fetal medicine center.

And Dr. Sebluski has come to the Birth Outcomes Initiative. She shared this information, as well as been helped by New American Institute of Ultrasound and Medicine Guidelines that gave our OB colleagues more information about not only looking four chambers of the heart, but also looking at the outflow tracts and some other details. And we're seeing improvement in the prenatal diagnosis, which is fantastic.

So going up from about 50%, up closer to the 60% to 70%, which is where we want to be. That's closer to the national average and such. So fantastic work going on, being led by our cardiology group, in getting these babies diagnosed prenatally.

And then the postnatal screen-- so we're not going to diagnose everybody prenatally. There are babies that are not going to be found at the ultrasound, that aren't even going to be found by a physical exam. And so that's why we're now doing the pulse oximetry screening that we try to do after 24 hours of life, but during that birth hospitalization.

And this has been interesting as a neonatologist. When we made this the standard in the state that we would be doing this pulse oximetry screening, I thought for sure that we were going to have so many false positives and just really all these babies who were going to be separated from their mothers and the cost of transporting them to MUSC for further evaluation and such. But this really works.

And we will get this baby in. And this baby will look perfect-- just completely healthy newborn. But they failed their pulse oximetry screening.

And we do our examine. There's nothing on our exam that we pick up. And sure enough, they will have a coarctation.

They will be a left hypoplast. So this really is working, because that baby would have been discharged without this screen and come in a far worse state, not looking as good as they do when they're coming to MUSC.

Moving out-- so moving out of that area of what we're doing prenatally and then immediately postnatally into then the third and fourth leading causes of death in South Carolina-- accidents and sudden infant death syndrome. So this is the slide that is the reason that I'm talking to you today.

So January 2016, I was sitting in a Birth Outcomes Initiative meeting. And Mr. Michael Smith from DHEC had just presented the 2014 data. And my brain was still thinking about very low birth weight infant mortality, because that's where I live, and was just not really thinking about him moving forward in accidents and such, because I don't do general pediatrics. So it's not as much where my mind is.

And so just looking at this-- but as a mom, raised two children and was really-- transportation, being in the car seat was so important to me. If that car was moving, they were strapped into a car seat.

And so I'm looking. I'm like, wow, in 2012, there were no-- or excuse me, 2013-- no infants in South Carolina died in transportation issues. That is fantastic. We're doing such a great job getting these babies in the car seats.

And then my eyes went up from there and said, oh, my goodness, 21 babies died in bed of accidental suffocation and strangulation. What is going on? And seeing then these numbers and how high they were-- 10 times the risk of dying in a car as the risk of dying of known suffocation and strangulation in bed. This isn't SIDS.

This is a known problem with breathing in bed. And those numbers were huge. And then looking at this next slide was the sudden unexplained infant deaths. And putting together then the accidental suffocation and strangulation with the SIDS-- the Sudden Infant Death Syndrome-- these numbers are shocking.

We have over one baby a week in South Carolina dying from either strangulation and suffocation in bed or SIDS. This is a big issue. And we've done so much to improve our transportation numbers.

Car seat work. And pediatricians have led that. So what can we do now to decrease these other numbers of sudden unexplained infant death?

Well, fortunately, as I finally got it together to write a talk on sudden unexplained infant death, the AAP came out with these guidelines this year, which has really, really helped. So very much of what I'm going to discuss now is based on these guidelines. And I have those references. Two differences-- they have both the updated guidelines, as well as the evidence-based for those guidelines.

So this is CDC data. But it was published in the AAP report. And it's just going up there to about 2014.

These are sudden unexpected infant deaths-- any sudden and unexpected death, whether explained or unexplained. So SIDS is part of this. But the SUID-- the Sudden Unexpected Infant Death-- is anytime a baby dies and it wasn't expected. So that could even be a baby who has an inborn error of metabolism.

So there's a genetic reason that that baby is going to die. If it wasn't expected-- if just at home, they pass and it wasn't expected, that is still a SUID, as well as, though, are SIDS and any time then a baby is strangled or suffocated in bed. And you see there that SIDS is still a big portion of SUID.

There was a nice decrease in the 1990s with the Back to Sleep campaign. The Back to Sleep campaign has worked. It has made a difference. But this continues to be a big reason of why babies in South Carolina and other places are dying.

The unknown cause is a little confusing when you think of the definition of SIDS. So the definition of SIDS is infant deaths that cannot be explained after a thorough case investigation. So that is, this baby died and we cannot find any reason-- no metabolic, no infection, no cardiac, no suffocation, no other reason, [AUDIO OUT] cause-- means that they know. They're just not sure what the reason is. So that's how that's different from SIDS.

And you see there that accidental suffocation and strangulation is increasing. Now it may be increasing just because things that were called SIDS previously we're now recognizing that it was actually suffocation in bed rather than SIDS. But still, this is increasing. And this is a major cause of death in South Carolina.

So again, the sudden and unexpected death, it can be due to infection, ingestions, metabolic disease, and trauma also, but then includes the SIDS and the sleep-related deaths. Critical and a lot of our coroners and medical examiners are going through classes to make sure that they are coding this correctly, because we're only as good as the evidence that they give us from the scene of the death.

And I give the ICD-10 code there. And if you ever have the opportunity to hear Kandy Kelley-- she's the coroner for Pickens County-- talk about what she is seeing there in the field, it is really just emotionally touching. She shows pictures of the scenes that she walks into.

She has had to purchase a baby doll so that the families could show how the baby was positioned as they re-enacted what happened. And she says as the family's talking, she'll find they start stroking and loving on the baby doll, because these families didn't want to lose their child. They are in such emotional distraught that they are actually, as they're going through this, that they're hugging on this baby. So it is really something that our coroners and our medical examiners are having to deal with.



Sudden Infant Death Syndrome-- so this was covered a lot in the AAP, especially the evidence-based portion of the AAP statement. And I don't remember learning about this a whole lot in residency. So I'm sure this is something that you all go over much more. But I just wanted to give a quick overview of what the AAP-- their summary.

So this was the triple risk model that was published in 1994 looking at why SIDS happens. And it does seem to be-- this has held true-- that you do have these exogenous stressors. You do have a baby being on their belly or a baby's face perhaps being in a blanket or such.

But that's not necessarily-- this isn't a suffocation. There's a stressor that the baby has. But that specific baby dies because there is a critical developmental period.

So that's why these babies are dying at, say, four months of age, but not at 14 months of age. It's not only that they can move, but it's also that it's a critical time in their development of their brain. And then they're also a vulnerable infant.

And so when a mom says, all of my babies slept that way, they're all alive-- they may not have been vulnerable infants. But this next baby may be the vulnerable infant. And the vulnerable infant, for some reason, have dysfunction that they then have a failure in methods to protect themselves.

So what makes a baby vulnerable? Well, absolutely being born preterm or being born with intrauterine growth restriction make a baby more vulnerable. Now we don't know that it's just because a preemie is going to have more issues.

It actually looks like whatever happened prenatally that made that baby born preterm or to be growth-restricted, that that same physiology/biochemistry may be why that is now a vulnerable infant. So that's something to keep in mind.

Definitely there's maldevelopment. There's potential for cardiac arrhythmias and such. Difficult to diagnose afterwards, because the heart's not beating-- so it's not like there's an EKG that we can take to Nicole Cain to look to help us to figure out, what is the rhythm dysfunction here? But we know that those are likely playing a role in some of these deaths.

And then delay in maturation of that autonomic nervous system-- so the vagus nerve and the cerebellar cortex. The theory that seems to have the most evidence behind it-- the one that's discussed the most in the AAP statement-- is this idea that it's a serotonergic neurotransmission dysfunction. There's a lot of serotonergic neurotransmission that's going on in the cerebellum, which is also very involved in our respiratory, our autonomic systems, and such.

You see there some of the reasons of dysfunction that have been found. And I think one thing that's critical, as I read through all the AAP statement, was the degree of risk with exposure to cigarette smoke or nicotine. So these babies who are exposed prenatally, their brains are wired differently. They have different metabolic development of their brains.

And we know, with this idea that it's this serotonergic neurotransmission, that the brain stem nicotinic acetylcholine receptors are strongly correlated with these receptors. And therefore, it's not just that post-natal exposure to smoke, per se, but that prenatally their brains are being wired to be a vulnerable infant. And that smoke or nicotine is making them a vulnerable infant for SIDS.

Again, those exogenous factors are a little rise in the carbon dioxide, a little pH imbalance in the bloodstream, ineffectual gasping. Then those factors are going to make the vulnerable infant, who's now in this critical developmental period, stop breathing and have cardiorespiratory failure.

We are fortunate that the same safe sleep practices that seem to decrease SIDS also seem to decrease the strangulation and suffocation. So it's great that it kind of, I guess, makes more sense the other way that those things that we can do to make sure that a baby's not suffocating or being strangulated would also decrease the risk of SIDS.

When you look at these recommendations, though, there are no randomized controlled trials. And we're not going to see randomized controlled trials with these practices at this point. We are left with case control studies, seems to be the standard.

And what the AAP has done is looked at strength of recommendation. They've put the evidence together and provide a grading system-- a level to the strength of recommendation. And what I'm going to present are those level A, which is the highest level they give, good, quality, patient-oriented evidence.

So the level A recommendations to prevent SIDS and SUID are supine positioning-- sleeping on your back-- on a firm surface, room sharing without bed sharing. Now this room sharing one, I've talked to more than one mother, pediatrician. And as we discuss these, we all say, I cannot imagine having my baby in the room with me for six months, which is what the AAP is recommending.

But the evidence is there. We've looked at it. And if you look at this evidence, it says that you decrease your risk. If you room share without bed sharing, the risk of SIDS decreases by 40%.

So that evidence is there. The baby should be in the room with the parents but not in the bed, at least for the first six months. Even though it sounds really difficult for those of us who wake up with any little sound.

No soft or loose bedding, avoid overheating and head covering, and then offering the pacifier-- you don't have to force them to take it, but at least offer it to the baby. If it comes out while sleeping, you don't have to put it back in. And that's the level A evidence based on case control studies and the AAP recommendations.

Excuse me, I should say, included with that, I kind of separated out the safe sleep and then have others here-- avoiding exposure to smoke alcohol and illicit drugs, and the parents breastfeeding, immunizing, prenatal care, and then avoiding cardiorespiratory monitors. So the AAP level A recommends to avoid the use of the cardiorespiratory monitors to reduce the risk of SIDS.

And then the next three really get into what we can do. And so there is level A evidence that if we are modeling safe sleep and talking about it with our patients, that the infant is more likely to not be a SIDS or SUID infant. Media and manufacturers can also change the products that they're making and not be making high-risk products. And then continuing the Safe Sleep campaign, because it really has been shown to be effective.

I bring up bed sharing. It is hard to bring up bed sharing as a breastfeeding advocate, because this is a hot, hot topic. And I try so hard to stay away from it, because it is such a hot topic.

But really, the AAP also recognized how difficult this topic is, to the point where in their statement, they actually brought in a complete outside expert in data analysis to look specifically at bed sharing. And not only did they bring in this expert, but they just quote him directly. No pediatrician wants to be the one making the call on bed sharing because of how strongly some mothers and cultures feel about this.

So brought in the outside expert to just look at the data and make a statement-- and he makes the statement that the evidence is out there that we cannot say that bed sharing is not a risk. Now I know that's a lot of "not's" and I sound like a lawyer when I say that. But that's what it is.

So bed sharing-- not every study shows that it's absolutely a risk. But there are enough studies out there showing that it's a risk that we really, as pediatricians, have to say, we know that you're coming from a culture of bed sharing, we know that you feel that your success of breastfeeding your other three children was because they slept in the bed with you, but as a pediatrician, this is the evidence, and your baby is at risk of SIDS or SUID if they are bed sharing. And that is what the AAP statement says.

It's even worse if smoking and drugs are involved with the parent. But breastfeeding isn't completely protective here. Even those breastfed infants are going to be at risk if bed sharing.

So what can we do during birth hospitalization, getting back to kind of the group that I'm leading on the state level, looking at starting things in the hospital? Well, I can't give a talk without having at least one breastfeeding slide, so this is it.

But we do know that breastfeeding decreases SIDS. That has been shown. This is another meta analysis that any base breastfeeding, based on the evidence we have-- I should say that. So we know, based on the evidence that we have, that breastfeeding decreases the risk of SIDS. And there is the forest plot showing that it favors breastfeeding.

But we have an issue that we're seeing more and more in hospitals. It happened more in Europe and is now coming into the US. And we actually are seeing it more as we have more breastfeeding mothers in the hospital.

This is sudden unexpected postnatal collapse. It's any condition resulting in temporary or permanent-- so it can be that a baby's found not breathing and resuscitated. So it's temporary or permanent cessation of breathing or cardiorespiratory failure in a well, term or late preterm infant within the first seven postnatal days.

They need to be late preterm or term. So it's defined as greater than 35 weeks. "Well" is defined as a normal five-minute Apgar and no requirement of resuscitation. And then the outcome can be death, but it could also be requiring intensive care or encephalopathy.

Breastfeeding decreases SIDS. I've shown you that data. About 36% is what the meta analysis shows.

Breastfeeding improves when babies are skin-to-skin or rooming in. So we're a baby-friendly hospital. And *The Lancet* did a beautiful review on breastfeeding in 2016, looked at all of the evidence of baby-friendly. And baby-friendly hospitals do have improved rates of breastfeeding-- about a 20% improvement. It is significant.

So being baby-friendly will improve the number of our moms and babies who are leaving breastfeeding. And breastfeeding decreases the risk of SIDS. But we also have then some extra risks.

So we have skin-to-skin and rooming in. Skin-to-skin by itself has been shown to have wonderful evidence for thermal regulation for the baby, decreasing blood sugar issues, and improving cardiorespiratory stability. And rooming in may not have as strong of evidence, but there are papers out there that it's associated with more patient satisfaction.

It also gives you that time to teach. So if we're going to want to be modeling safe sleep for our moms and teaching the families about infant care, we need to have the baby in the room so we can actually be doing that instead of having baby in the nursery. They will understand a whole lot more of what we're teaching if the baby and mom are together.

But we are seeing this increase in the sudden unexpected postnatal collapse as more and more hospitals are becoming baby-friendly and having more skin-to-skin time and rooming in. So some people say, well, then that's it. We need to get the babies back into the nursery. We need to have better control of them.

I'm advocating, let's not go backwards. Let's keep moving forward. There's just more work to do.

And unfortunately, every time you improve something, there's often a new risk that comes up that you have to deal with. And this is our big risk. This is what we need to be dealing with at the state level to make sure that as we support more breastfeeding, that we also have the right protective mechanisms there.

So there's been many case reports of the sudden unexpected postnatal collapse with skin-to-skin and rooming in. And we're also seeing more infant falls. It may be that they're being reported more, but it does seem to be a significant increase now that the infants are with mother more often.

So what can we do? I'm still working on how we're going to move forward with this at the state level, but this is what I have so far. So using the vowels-- A, E, I, O, U, but especially the A, E, and I-- Assess, Educate, and Incorporate.

Oh, and I should mention, fortunately, we also have guidelines for this. Lori Feldman-Winter-- wonderful that the person writing the AAP statement on the sudden unexpected postnatal collapse is also a huge breastfeeding advocate and expert. So really working together to pull-- the breastfeeding leaders are the ones moving forward with this protection.

We have to assess maternal fatigue and maternal unsteadiness. Our mothers are very, very tired. And so we've got to be aware of that, be educating our nursing staff on that appropriate assessment.

Take what we've learned from fall prevention. We've seen many hospitals, as they go baby-friendly, they have a lot of babies falling. They realize that the beds that they have their moms in are set up for a baby to fall. So they've had to change out their beds so that we have safe equipment to protect mother and baby.

And then also assessing specifically our at-risk infants-- those requiring resuscitation, low Apgars, the late preterm and also the early time are most at-risk and those who've had a difficult delivery. Maternal fatigue needs much more study. In the studies that have been performed, there's something called Second Night Syndrome.

That first night after you delivered, you have this wonderful adrenaline rush still going on. And you honestly can't sleep-- just all of the hormones that are going through your body. That second night, you're finally fatigued.

Meanwhile, your baby, who was so quiet the first 12 hours, is starting to wake up and wanting to eat every 30 minutes. And you have this fatigued mom. And it's about 3:00 in the morning that they really-- the mother and baby are not combining well.

And that is when most of these sudden unexpected postnatal collapses occur, if they're going to occur, because mother fell asleep breastfeeding, holding the baby. This is a real issue, the maternal fatigue, and these are the risk factors associated with increased maternal fatigue.

Assess-- well, the sudden unexpected postnatal collapse is going to occur-- most of those are going to occur in the first two hours. Then a third are going to be in the first two days and a third in the next two to seven days. So making sure we know when are the most important hours to be monitoring, because that's when this is most likely to occur.

Frequent assessment of the nose and mouth and head turns when that mom and baby are skin-to-skin, and plan for this, following the guidelines of how many nurses we need, how many care providers we need, to make sure mom and baby are protected. And in fact, in the United Kingdom, they hired nursing students to come in in those early morning hours, about 3:00 AM, so there were extra observers around the postpartum unit to look for mothers who might be falling asleep while breastfeeding.

Educate-- we just need to know this exists. Make sure the staff knows that this is a risk that's increasing, as well as moms and families. The dads, the moms, they need to know that this can happen in the hospital.

And then Incorporate-- we're working on a scoring system for maternal fatigue. It needs to be a reason that a baby can be removed from a room, identifying what is defined as maternal fatigue. Safe equipment, increasing our numbers, and then what has maybe-- so the evidence is evolving.

One of the biggest things we could do is what we're doing here at MUSC-- we call it cuddle time-- but having an afternoon time that nobody enters the room, and mother and baby can hopefully both get some rest. And really, I think for this to work to truly decrease the risk to these infants, we need to change the culture of everybody coming in to visit these mothers when they deliver babies. They are entertaining the entire day. There is no nap time, constantly people coming in. And we need to change that culture and educate and really protect that time so that mother can get some rest during the day.

Real quick, parental fatigue-- so continuing on this fatigue, this is one of my favorite studies. This was just published in 2016. And just to show you that the moms and dads in this study, they were highly educated. Racially, it was a group less likely to have sudden infant death, more likely to be following the Safe Sleep campaign.

It was a white, college-educated group, and as well as 82% were married or cohabiting-- so two adults in the house. And what they did is these investigators videotaped during the night-- these parents knew they were being videotaped-- to look for safe sleep. And this is what the study showed.

So what they showed is at one month, 21% were on a non-recommended surface, 14% non-supine-- so not on their backs-- 91% had loose, non-approved items, and 9% were in a shared sleep location-- so sharing a bed. So those were the numbers that they saw for the first location that the baby was put to sleep when they looked at what was going on at one month of life.

So not too bad-- could definitely be better. But for the most part, 86% of these babies were put on their back. Of course, we would like for it to be 100%.

Where the problems really occurred were the second location. So this is when in the middle of the night, probably because they fed the baby or the baby cried, the baby gets moved. And at that point, 91% were on non-recommended surface, 36% non-supine, two to three non-approved items were in the sleeping surface, and 67% now shared a sleep surface. Parents are fatigued. And even when they know they're being videotaped, they are still making the wrong decisions.

So what do we do? We've got to combat this and help them and help them with ways to manage fatigue. We need research on ways to manage fatigue to really help the parents make the right decision in the middle of the night. I think we can do this.

We did this with transportation. Back by 2000, appropriate positioned car seats for greater than 90% of babies and a 71% reduction in infant fatality from car crashes-- that is what we were able to achieve in pediatrics. Now can we do the same for the safe sleep, because 13 deaths of transportation, compared to the 194 strangulation or suffocation and 265 SIDS-- that's what we're seeing in South Carolina.

So it's time to do the same. Start with education. Start with just making sure that families know. I didn't know this was going on. I'm glad I'm not having another baby, because I would not have known that this was such a risk for my child. I don't think it would have really gotten through to me.

So it is really important to get that education out there so our families at least know, you did great with the car seat. Do you know your baby is 10 times more likely to die because you put them in the wrong sleep position? Make sure they have that information.

And focus specifically on those middle-of-the-night decisions. And we have to get to where we had this visceral response, because I think you see this picture in the car, and those are-- I know I sure do-- I have the tightening of the stomach. I want to call the police.

I want to stop this mother and say, please, this is unsafe-- a true visceral reaction. We have to have the same reaction when we see that beautiful bed that is completely full of death traps. And that's what we have to get to in what we're doing.

And so unfortunately, I don't have great tools for you. But I can say that the Children's Trust of South Carolina is leading this. They are the go-to place in South Carolina, as well as we're working, especially in hospital safety, through the Birth Outcomes Initiative.

All right. Thank you.

[APPLAUSE]