Speaker 1:

Research is really important, because by definition, it's the only way to get new knowledge. There's so much that isn't yet known, that it's just a cool time to be in science.

Speaker 2:

At the end of the day, what really gets us out of bed in the morning is just the curiosity trying to understand things we didn't understand the day before.

Cole Cullen:

Welcome to Reach, the podcast that tells the stories of researchers, their studies, and how their work impacts you in the world you live in. I'm Cole Cullen.

Beth Banford:

And I'm Beth Banford. Today, we're going to tell you about the family. More specifically, the research being done at Penn State about families.

This is the first episode of the Reach Podcast. Each episode has a theme. The theme of this episode is families.

Cole Cullen:

Our first researcher is Paul Morgan. He is with the Department of Educational Policy Studies at Penn State.

Beth Banford:

Dr. Morgan specializes in setting kids up for success in their early years.

Cole Cullen:

Beth and I are both parents and we've had experiences and challenges with our own children, going through their early years of education. So we can understand how important this kind of research is for students and their parents.

Paul Morgan:

My name is Paul Morgan. I'm a professor at Penn State. I conduct research that examines risk factors for different disability conditions. I try and understand what happens to children over time as they move through school, and how we can better help children, especially those children who might be at risk for having disabilities, or maybe struggling academically or behaviorally in school.

Cole Cullen:

Tell me where you started and how you got here.

Paul Morgan:

After college, I started working with boys with emotional and behavioral disorders in an outdoor camp. Many of these children were court sent, because of various offenses they committed as juveniles. And I became really interested in how children develop and the kind of choices they make over time. As a result of that, I ended up going back to get a master's degree to become a special ed teacher, and so I

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taught as an elementary, self-contained and resource teacher for a number of years. Then I went back to school, and furthered my training in how to understand development, not just anecdotally or from a case to case perspective, but more from a population based perspective. Who is likely to struggle, and how can we better help those children, is a really motivating a set of questions that guide my research.

Cole Cullen:

When you say struggle, how do you define struggle?

Paul Morgan:

So one of the things that I noticed when I was a special ed teacher, is that by a third or fourth grade, some of the children I was working with, if we were done with the academic tasks in my classroom and I said, "Okay, well just use this free time to get some reading done. Here's some books you can turn to." For some children, that was a really adverse type of choice I'd given them, they didn't want to do that at all. And I was surprised by that and like, why are children this young, from my perspective in their development, starting to turn away from something that I know, as an adult, is really important?

And so, I started trying to look at why did children start to struggle in reading, and also what are the behavioral consequences of that? And one of the things that I looked at through a line of research is whether children who are struggling academically. Does that start to affect their social-emotional development? And through a series of studies have found that there seems to be evidence of that.

Cole Cullen:

So is it safe to say that, you were in the classroom, you were on the front lines essentially, and you saw a need which motivated your research?

Paul Morgan:

Right, that's right. When I was going through graduate training, there were very few longitudinal studies of children's academic development, and a typical instructional response that you would have from teachers is, "Well, let's wait and see." So, Johnny is having difficulties in kindergarten or first grade, "That's okay, that happens, he'll grow out of it." There's been a lot more longitudinal studies of that phenomenon, which clearly indicated across a number of academic domains that tends not to happen.

Kids that struggle early tend to struggle later. Which has moved much of the conversation from a wait and see perspective, to more like, "Well, that's really kind of a wait and fail perspective." And we should be, especially those kids who are repeatedly struggling in kindergarten or first grade, we really need to be trying to deliver more intensive interventions, otherwise they're likely to continue to struggle, and what tends to happen is then other things start to kick in as well.

So now, Johnny is not just struggling to read, now he really hates reading and he doesn't want to do it. That makes it worse. And when you ask him to read, he might lash out. Well, that's another problem that's difficult to address, but these things compound over time. So a line of the research that I've been helping to lead and conduct, is that a sizeable number of the kids that struggle early, those kids really do need extra supports, or else we're just shrugging our shoulders and letting them continue to struggle, and become worse off as a result.

So there's an office in the US Department of Education called the National Center for Education Statistics. And they specialize in collecting large samples of children, some of whom are followed across time. These studies would be well beyond the resources of any individual research team or even university.

20,000 children, initially, who were then repeatedly assessed. Children's academic achievement is individually assessed, parents are assessed in regards to the children's behavior or characteristics of the home. Teachers can complete surveys of the children's development characteristics of the school. The community are also collected and then they make this data accessible to researchers across the country. So we're not working with real kids, but the data represents real kids and their performance on these assessments. And because of their rich data collection on these children that allows you to investigate a range of different questions.

One set of questions that we've been investigating are pertained to cognitive characteristics of children which are referred to as executive functions and how they relate to children's academic achievement across time.

Cole Cullen:

Elaborate a little bit on what an executive function is.

Paul Morgan:

Sure. So executive functions are sometimes referred to as the air traffic controller of the brain. So, you as a learner have a lot of inputs that are coming in and you're making decisions about how to use and organize that information. Three main types are referred to as working memory, cognitive flexibility and inhibitory control.

Working memory is the ability to store and manipulate for brief amount of time, some amount of information. If I give you a string of numbers, say one, two, three, four, five and ask you to repeat them back to me in reverse order. You've taken that in that information and then manipulated it in some kind of way.

Cole Cullen:

Five, four, three, two, one.

Paul Morgan:

Good answer. And I can make that task more complex than that.

Cole Cullen:

That's okay.

Paul Morgan:

But that's the idea is you're taking it and using for brief amount of time information or manipulating that information.

Another type of executive function is called cognitive flexibility. This is the ability to process information, giving changing rules. So a simple task for this that you might give children as I give you a set of cards and they vary in terms of the color of the car and the border type that the card has. And I ask you to sort them in different ways. Changing around the room in which you process.

Another main type of executive function is called an inhibitory control. And this is when you down-regulate initial response that you might make. So in the classroom, this by be the child that wants to blurt out the answer but instead remembers he's supposed to raise his hand. So he's down regulating, holding off on the initial response he wants to give and instead selecting something that's more

appropriate. These are cognitive processes is that been hypothesized to relate to children's learning in classrooms.

And there's been a good deal of study, but there's been some limitations of the research too. So we took the data that has been collected by the department of education and made available to researchers. We've applied a new method to understand out and we can identify kids that seem to come into kindergarten and start pretty high academically and tend to stay high. But we can also identify classes of kids who come into kindergarten classrooms in United States and tend to start pretty low and then they tend to stay low.

So relative to their peers they might display pretty significant achievement gaps across time. We wondered, well who are the kids that are especially likely display low levels of achievement in reading, math and science. And that's where the executive function part comes in. What we found is that indeed it seems to be the case that if you have a deficit in working memory, flexibility or inhibitory control that those children were more likely to struggle academically across multiple elementary grades.

I would be concerned as a parent of my children was displaying that level of academic struggle across time.

Cole Cullen:

You're not saying that these kids are lost causes you-

Paul Morgan:

I am not saying that.

Cole Cullen:

You're saying let's help them earlier?

Paul Morgan:

Yeah. It's never too late to help a child. These struggles may be due to a disability. It may be due to an instructional mismatch with what's going on in the classroom. There are different reasons why might be occurring and certainly we want to consider multiple explanations.

But that to me, the last thing we want to do is just throw up our hands that just making the problem harder to address, because the child's academic struggles will tend to start influencing or affecting other aspects of his or her development.

This kind of research suggests it's really important to assess children early and repeatedly on general measures of achievement and then use the knowledge that's obtained from those assessments to identify those children who are off track and provide additional supports for those children.

For those kids, we need to be a particularly worried and being, providing all the additional help that we're able to provide.

Without the kind of research that we're conducting, we'd know a lot less about, in my view, how to help children grow and succeed. And it's important to do this in a way that scientific and not just based on anecdote, because there's a long history of anecdote leading us to places that we don't want to be or situations that we don't want. So what I'm trying to do is conduct scientific investigations that are rigorous and stand the test.

That are rigorous and stand the test of time in terms of evidence because if the investigation meets those conditions, it's more likely to inform future decision making, future practice. Those kinds of

investigations that are scientific and rigorous, they require resources, they require time, they require personnel, they require funds, and they're difficult to do in a place that isn't able to provide time and resources and the supports needed to conduct high-quality science that informs the human condition. Penn State is one of those, in my view, one of those institutions that really excels at providing resources to support scientific inquiry that advances the human condition.

PART 1 OF 3 ENDS [00:12:04]

Speaker 3:

Our next researcher is Dr. Orfeu Buxton, a neuroscientist that studies sleep. Cole, you sat down with Dr. Buxton. What did you learn?

Cole Cullen:

I learned that sleep is very important to many aspects of your life. I also learned that the amount of sleep that I want to get is actually the proper amount of sleep that I should get, but I don't necessarily get that much sleep because no one leaves me alone when I'm at home.

Speaker 3:

Maybe your work will send you home with a note to your family that says that you need to get enough sleep every night.

Cole Cullen:

I need to be allowed to sleep.

Speaker 3:

To perform highly at work.

Cole Cullen:

We'll see how that goes.

Orfeu Buxton:

Hi. I'm Orfeu Buxton, Professor of Biobehavioral Health at the Pennsylvania State University. I'm a neuroscientist by training. I fell in love with neuroscience at the University of Pittsburgh as an undergraduate and then went to Northwestern University in Evanston, Illinois, for my graduate work in neuroscience. During that period, I also did lots of sleep experiments and I didn't consider them sleep experiments at the time, but they were fundamental explorations of ideas that I now understand better as sleep research. So for example, trying to find the right amount of time that you need to be your best in the morning. I did that experiment in college on myself, and so over the course of doing many of those types of experiments and in denial that I needed more sleep than I was getting, I came to have a deep appreciation for how embedded sleep and circadian rhythms were in our everyday lives.

Circadian rhythms are 24 hour biological rhythms in the body and they occur in the absence of any environmental input. So it's not that it's light or dark because of the sun, it's that we have an endogenous or generated rhythm in our body, in our brain that modulates physiology throughout our brain and our body.

Cole Cullen:

So let's talk about the fragile family study, how you got involved in it and maybe some of the initial goals of the study.

Orfeu Buxton:

So the fragile family study is an amazing effort that started in the late 90s out of Princeton. Mothers were recruited when they were in the hospital to give birth, and it was over-sampled for single mothers such that the resulting sample was enriched for those of lower socioeconomic status, less educational attainment, and so on. And we came in with an R01, a typical National Institute of Health or NIH grant, at age 15 specifically just to add the sleep and a daily diary and physical activity. So we asked the participants when they were now teens to wear a watch.

There was an accelerometer, or tracks their sleep patterns, and a physical activity monitor on their waist that tracks their exercise and sedentary activity patterns, and then we were able to, when all of those data were collected, relate their household structure and their upbringing and how parenting had gone for them say around bedtimes, how all of those factors including family structure, influenced their health behaviors of sleep and physical activity at 15, their health risk behaviors such as sedentary behavior, and associate those with things that were context like their local school start time, household factors, how things were with their parents, and how things were for them at school and their personal life and with their friends. Nobody had done this scale of national study in teens with these types of measurements with decades of prior data collected on not only those people, but other members of their family.

Cole Cullen:

Were you looking for specific things? Was this just an opportunity to study sleep in general?

Orfeu Buxton:

We were interested in targeting contextual factors and sociodemographic factors that predicted sleep in teenagers. So family structure, poverty, those kinds of things all the way through childhood, because we were interested in sleep disparities. We were also interested in how daily patterns of sleep and physical activity would influence other factors related to wellbeing, and also what predicted the sleep and physical activity levels. First, to no one's surprise, we replicated prior findings that most kids and teens are sleep deprived, at least half are getting less than the recommended minimum amount of sleep. It may be that teens are the most sleep deprived segment of the US population right now.

I'd like to talk about the National Sleep Foundation Sleep in America poll, and we published a paper in 2015 looking at sleep duration and sleep quality in US children and adolescents. We looked in households for predictors of that short sleep and poor quality, and we found that parenting and household factors around devices mattered for kids and teen sleep. Factors that caused children to not get age-appropriate amounts of sleep included kids who had caffeine. So the ideal group was that parents always limited kids caffeine. Only those children had age-appropriate sleep duration, or they were much more likely to have age-appropriate sleep duration when their parents limited their caffeine.

If they had one device or more on in their bedroom overnight, they were much less likely to get age appropriate sleep. If they had no devices on in their bedroom overnight, they were much more likely to get age-appropriate sleep. For sleep quality, we found that children having a bedtime improved their sleep quality. So this is getting back to the idea of the regularity of sleep. Timing and duration is probably as important as the amount. If they had a regular bedtime, then those kids were much more

likely to sleep well. If your bedtime varies a lot, you're essentially fighting your circadian rhythm that wants you to go to sleep about the same time each day. So even if you're really sleepy, it's hard to go to sleep before your circadian system would allow it. And the other factor predicting poor sleep quality in this sample of kids and adolescents was, not surprisingly, having a device on in the bedroom. So just like with sleep duration, having a device on in the bedroom overnight degrades sleep quality in kids and adolescents.

So this is data from 2015. I would say since then, the penetration of smart phones into the very being of children, it's really a problem for sleep at night if a smartphone or other devices are around. It really didn't matter the kind of content or device or the type of thing that they were doing, through all of those pathways, further increased depressive symptoms. Those effects of device use on depressive symptoms were mediated by these different sleep disruptions that they caused.

Cole Cullen:

This is not meant to sound disrespectful to the research, but you tell me kids shouldn't have devices when they go to bed and they shouldn't have caffeine before they go to bed. Well, no kidding. I'm a parent and I know these things and I didn't need a researcher to tell me, so having done the research and having actually the knowledge and the proof to back it up, how does that help the family ultimately?

Orfeu Buxton:

You're onto a very important point. So all of this research that I'm describing has an orientation where we are attempting to design an intervention to change what needs to be done. So you say everybody knows this, yet it's not happening. So there's a difference between knowing what's good for you, eating your broccoli, and actually eating the broccoli. And so this research is designed to move to the eating rather than to just the knowing that the eating is good.

A finding that is particularly interesting in the fragile family study is the longitudinal observation of childhood bedtime routines and sleep at age 5 and 9, and how those influence or predict age 15 sleep and health. So in that study led by Soomi Lee, an HDFS graduate student at Penn State, now a faculty member at the University of South Florida, Soomi put together a latent class analysis where we looked at different types of sleepers and parenting strategies in children to see what would happen when they were teens. And what we found is that only about a quarter of kids had age-appropriate bedtimes and not surprisingly, they got age-appropriate sleep duration on average. So we know parenting and bedtimes matter for getting adequate sleep.

Other groups, the higher-risk groups, had little or no bedtime and they didn't get age-appropriate sleep. What we found is that those groups then predicted their sleep as a teen, so having no bed time and not getting enough sleep as children predicts not having a bed time and not getting enough sleep when you're 15. And then they also have higher BMI as a teen. So it's influencing not only their future behaviors, it's influencing their future health, and if you already have a higher BMI as a teen, that's predicting longterm cardio-metabolic consequences happening earlier than they would for a typical adult.

How we conclude from those findings is that parenting matters. You don't always get to feel that as a parent, but a bedtime really matters for the next day how they are at school, how they are with other people, lots of elements of success, but also predicts their sleeping patterns and health behaviors when they're teens, and says a lot about their physical and mental health.

Cole Cullen:

Sleep is important. You can't sniffle.

Speaker 3:

Oh, are we on? We're going?

Cole Cullen:

We're going.

Speaker 3:

I didn't get enough sleep last night.

Cole Cullen:

Not only is sleep important, but-

PART 2 OF 3 ENDS [00:24:04]

Speaker 4:

I didn't get enough sleep last night.

Cole Cullen:

Not only is sleep important, but aging in a healthy way is also important.

Speaker 4:

Our last interview is with Dr. Martin Sliwinski and he talks about how we can lay the foundation for healthy aging.

Marty Sliwinski:

I'm Marty Sliwinski, I'm a professor in human development and family studies and I also direct the Center For Healthy Aging.

Speaker 4:

Part of this podcast is to share your research and your story with regular, everyday people. So why would everyday people care about what you're working on?

Marty Sliwinski:

So I think we'd all like to do better, to be better, to perform better at work, to make fewer mistakes and find ways to optimize our lives. And the work we're doing is directly related to how to help people do that and this relates to people, like yourself, who may just want to make fewer mistakes at work or be more mentally sharp or more productive. But it's also important when you think about people who are a little bit older, where a cognitive error they make, a mistake could be high stakes, right? So imagine a person in their seventies who's driving, who their vision isn't quite as good, their reflexes aren't quite as sharp, and if they're preoccupied with stress, they're more likely to be distracted and make a mistake that can lead to a high stakes cognitive error and a crash.

So what we think we can do with this technology and this approach is to try and identify when people are in those high risk situations and intervene before the problems happen. And one of the ways in which you can do that is to focus on not just managing illness and disease and disability, that's very, very important work, but we're really interested in what people can do when they're younger, when they're in their thirties, forties, midlife, fifties, sixties, what they can do to lay the foundation for healthy aging as they move into their seventies, eighties, nineties and over a hundred. And the work we're doing is trying to provide cost effective ways for using digital health methods to help people prevent problems before they happen, identify what needs to be addressed, and also importantly, reassure people if things are going okay so they don't worry needlessly about issues that really aren't issues.

When you look at how society's changing, we're at the turning point of a sort of a cultural climate change. In 2035, in about 15 years, for the first time in human history, there'll be more people age 65 and above than young people aged 18 and under. That tipping point is really going to change how society's made up. The number of centenarians, people who live to be a hundred years or older is going to increase by about 600% over the next 40 years and there'll be over 6,000 people in the United States by 2060 who are a hundred years or older. That's three times the size of the city of Pittsburgh and we don't know what to do with them, and they don't know what to do with themselves and we need to figure that out. And one thing I can say for sure is that a healthier 50 year old makes a healthier a hundred year old. So, it's never too early to start thinking about what your second life is going to be like.

You know, it used to be that for some of these types of tests we wanted to do, we'd have to bring people into the lab or the clinic and use a computer to do that or have a trained technician or research assistant administer a test. But now, the computers that we carry with us in our pockets, smartphones are way more powerful than what used to sit on our desktops even just 10 years ago. So that's really opened up the doors to where we can put a laboratory in everyone's pocket, essentially. And we use not only the smart phones to ask people questions or have them play brain games, we can use the smart phones to measure their physical activity, their posture. Our colleagues in Sage Bionetworks have developed algorithms where we can evaluate gait abnormalities in people with Parkinson's disease just by having them keep the smart phone in their pockets. And we're actually already doing, using the mobile technology in a study in the Bronx, New York to try and and see how we can improve the early detection of Alzheimer's disease, hopefully, to improve interventions to prevent it.

Speaker 4:

So you've identified your sample population, you have the technology available to collect the data, what do you do after that?

Marty Sliwinski:

So after we collect the data, that's actually where the fun begins. It's a rich environment for being able to do this kind of research, but sometimes we have so much information, we don't know what to do with it. So we work with colleagues in engineering and in our own department who are experts in machine learning and other types of sort of high intensity computing analytics to try and make sense of all the different data streams we get. We also are interested in trying to improve the ability to be able to detect subtle cognitive changes that precede the development of things like Alzheimer's disease. So finding ways to do that a little bit more efficiently, and we're working on two projects at have a bearing on that

You know, in some ways, we begin to age physically and cognitively in our twenties and early thirties. So what are things you can do, these are the common sense things. Diet is very, very important and not just eating the right foods or not eating too much, but there are certain kinds of diet that may be very

beneficial for your brain health. So we're doing a study on the Mediterranean diet and to see whether or not people who are taught how to eat according to the Mediterranean diet, nuts, healthy oils, reducing the amount of dairy people eat, whether that improves brain health and reduces a risk for Alzheimer's disease. And beginning to do that in your thirties and forties is better than waiting until you're in your seventies or eighties.

Speaker 4:

What made you interested in this type of research?

Marty Sliwinski:

I may have been destined to work in the area of aging from when I was a little kid. My parents were older when they had me, so my dad was 48, my mom was 42. They tell me I ruined their retirement. So I was always sort of around people who were a little bit older and I had to experience, firsthand, some of the challenges that happen to aging parents when I was still in my twenties and thirties, and that's maybe why I was kind of destined or interested in this topic. And a little bit was just by chance, it was what the opportunities were before me when I was in graduate school.

Speaker 4:

My parents are in their seventies and I'm always worried about what could be happening to them and so it sounds like the things you're working on sort of are relevant to my parents. So what ... Are there things that they can do now or learn from your study now?

Marty Sliwinski:

Ultimately, what we'd like to do is to be able to provide user-friendly tools, engaging tools that people like your parents could use that could help monitor their functioning, their emotional functioning, their cognitive functioning, their physical health, and identify issues before they become issues. So not to try and solve a problem after it's happened, but trying to say, "Hey, your balance and gait has been a little bit odd, a little bit unusual. Maybe you should go to the doctor," and there could be a medication before they fall. So I think the tools we're developing, ultimately, I'd want to see them in the hands of people like you and your parents so we can make people's lives better in that way.

Technology lets us do that. If we're interested in trying to understand how everything that transpires on a daily basis happens to us, we have our smart phones and our smart phones allow us to capture this information in very precise and user friendly ways. In the center, we're really interested not just in promoting health of individuals, but promoting ways in which people from different generations can communicate with each other. And I think just even having a session, a podcast like this where we talk about issues related to aging and just get this out in people's attention in the public ear, that's really, really, very valuable.

Speaker 4:

Thank you for listening to Reach and a special thank you to Doctors Paul Morgan, Orfeu Buxton and Martin Sliwinski.

Cole Cullen:

And don't forget, all the episodes of Reach can be found on our website. Please consider making a contribution to WPSU so that we can bring you content like this. Visit wpsu.org/donate. Thanks.

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