Narrator:

Welcome to Optimal Neuro|spine podcast, a podcast about optimizing our brain and spine in health and disease. Each episode, leading neuroscientists, neurosurgeons, educators, patients, spine care, and quality improvement experts discuss their research, experience, emerging science, surgical advances, and insights about how to optimize neurological and spine care. Now here's your host, Dr. Max Boakye.

Dr. Max Boakye:

Welcome to the Optimal Neuro|spine podcast. My guest today is Dr. Sara Guilcher, who is an assistant professor on the tenure track at the Leslie Dan Faculty of Pharmacy, and has cross-appointments to the Rehabilitation Sciences Institute and the Institute of Health Policy and Evaluation at the University of Toronto, Ontario, Canada. Dr. Guilcher, over the past several years, and her team have investigated polypharmacy and medication self-management for persons with spinal cord injury. To date, she has published over 90 peer-reviewed publications and has held more than $2.6 million in grants as the principal investigator or core principal investigator. We're happy to speak with her today regarding the problem of polypharmacy in spinal cord injury patients. Dr. Guilcher, welcome.

Dr. Sara Guilcher:

Thank you. It's good to be here.

Dr. Max Boakye:

Can you describe to us what you do in your current roles?

Dr. Sara Guilcher:

As you mentioned, I'm an assistant professor at the Leslie Dan Faculty of Pharmacy. I'm also an embedded scientist with Ontario Health in the quality branch. And so with my role, I have a mix of research, teaching, and service that I do for the university.

Dr. Max Boakye:

Excellent. What is the definition of polypharmacy? What do we mean when we say polypharmacy for spinal cord injury patients?

Dr. Sara Guilcher:

This is a great question and the definition varies a lot, and that's not just within the spinal cord injury field. That is also with the general population, which I think speaks to some of the problems, I think, with collating and combining research and study farming. So, as we showed in our scope and review that was led by my master student at the time, Lauren Cadell, there's a wide range of the number of trials that are considered. Some people use the definition, which is more common, as five or more at concurrent drugs at the same time, but some people also look at the definition as just being with prescribed drugs. However, others consider prescribed and non-prescribed, such as over the counter and natural health products. The definition varies a lot. I think the most common definition, though, I would say, that's used is five or more drugs that someone is taking at the same time, and that includes prescribed and non-prescribed.

Dr. Max Boakye:

How or why did you become interested in this problem?

Dr. Sara Guilcher:

Well, for a couple of years now, I've been studying secondary complications and multi-morbidity from a health services lens. And it occurred to me that there could be a bigger issue of polypharmacy and related management. Given the complexity, we know that people with spinal cord injury are not only dealing with the complexity of the injury and the secondary complications, but there's also accelerated aging that can happen when someone has a spinal cord injury and you're experiencing multi-morbidity, so multiple chronic conditions. And how we typically treat these conditions in the general population is with pharmacological therapies, so with drugs.

Dr. Sara Guilcher:

And so when I had preliminarily scanned for literature, I had a sense that there was a gap. And certainly this was more formalized when Lauren Cadell, my master's student, was working with me, and as I mentioned, by that scope and review, to look at what's known out there in terms of polypharmacy and spinal cord injury specifically. And we actually found that very little had been published, which led us to apply for pilot funding through the Craig H. Neilson Foundation to allow us to explore more of the scope of this issue from a quantitative perspective as well as a qualitative perspective.

Dr. Max Boakye:

Okay. Before we go any further, let me ask you about your own background. Your credentials are PT, PhD. So you're a physical therapist by clinical training?

Dr. Sara Guilcher:

Yes, that's right. Yeah. I'm actually, I'm not a pharmacist, I'm a physical therapist. So it's an interesting lens to be taking for someone on this area of research who is not a specialist in pharmacological therapy. I'm really interested from the de-prescribing perspective and how can we provide people with non-pharmacological therapy options. So while recognizing certainly that there is a time of need for drug management and medication management, my lens is trying to take it from more of a person centered lens, thinking, how can we empower individuals from a self-management perspective such that we could be offering alternative options to medications and/or supplementing medications with other therapies?

Dr. Max Boakye:

I see. So as a physical therapist, you do work sometimes with spinal cord injury patients?

Dr. Sara Guilcher:

Clinically, I do not practice anymore as a physical therapist, so not in my clinical practice. However, there's people on my research team that very much do work in a clinical capacity with people who have spinal cord injury.

Dr. Max Boakye:

You mentioned that there wasn't a lot of scientific work or publications in this area. Why is that? What is the prevalence of polypharmacy? Is this not a major problem?

Dr. Sara Guilcher:

It is actually quite high, but again, the prevalence varies very much on how people conceptualize and define polypharmacy. As I mentioned before, there's a lot of heterogeneity in the literature in terms of, are people using the five or more definition? Are they using 10 or more? Some people use a little bit of a lower threshold. And are people considering prescribed and/or non-prescribed? But generally, I mean, there's a very big range because of that. In our spoken review, we identified a range of around 30 to 90%. in our administrative health data, where we were able to look at all of the health claims of Ontario in Canada, Ontario's Canada's largest province, we identified that almost 90% of our cohort of people with spinal cord injury were on five or more different drugs that were prescribed. So certainly from our research, we would suggest that the prevalence is quite high among people with spinal cord injury.

Dr. Max Boakye:

What are the risks and impact of polypharmacy?

Dr. Sara Guilcher:

Yeah, that's a great question. So firstly, I just want to, I guess, maybe contextualize it all. Not all polypharmacy is bad. Certainly, certain medications are indicated based on clinical situations, preferences of the individual, and within the clinical situation and context, the medication has been well-assessed in terms of benefits, certainly some medications are indicated. Where it becomes more problematic is certainly see if people are on five or more medications, we know that adherence to medication starts to become more difficult. There are more interactions with drugs. And so we just see that there's more drug therapy problems when people are prescribed more than five different medications. Certainly, I think that's where it can become problematic.

Dr. Sara Guilcher:

There are certain risk factors that we've certainly identified in our research. People who have more co-morbidities are more likely to be prescribed more drugs, and I think this makes intuitive clinical sense. And we also see that there's some sex differences in types of number of medications that are being prescribed in our data. So there's a couple of different factors that I think influence whether or not someone is being prescribed medications. But again, not all medications and not all polypharmacy is problematic.

Dr. Max Boakye:

What about older patients? Are they more likely to be on polypharmacy?

Dr. Sara Guilcher:

Yes, exactly. And we see this in the general population, too. So this is not unique to people with spinal cord injury. We see, in the general population, that older adults typically are prescribed more medications in that. That is virtue of the fact that, in simplistic terms, that individuals might have more co-morbidities, so therefore they may be prescribed more medications to deal with these issues. In the general population, there's new terms and new movement now kind of happening with concepts like de-prescribing and thinking about prescribing cascade.

Dr. Sara Guilcher:

So in the general population, this is in shown through some colleagues of mine, like Dr. McCarthy in Toronto, that is really looking at the extent to which people are prescribed medications to deal with side

effects of another medication. So it kind of causes this domino effect of being prescribed medications to chase the side effects of another. And so that's why it's really important for prescribers and for people who are receiving these medications to think critically about, why are they taking the medications? What's it for? Is it helping? Are there side effects? And having these ongoing conversations, because if there are side effects, then maybe there's things that can be done with the dosing. There's different strategies that can be taken before one might be prescribed another medication to deal with the side effect.

Dr. Max Boakye:

With regard to the risks, any the differences between traumatic versus non-traumatic spinal cord injury?

Dr. Sara Guilcher:

There definitely needs to be more research in this area. There's very little that has been conducted thus far. I think just clinically, just thinking about etiology and the clinical profiles of individuals with traumatic versus non-traumatic, certainly most individuals with non-traumatic spinal cord injury are older. So by virtue of that, I think that they more likely would have other pre-existing comorbidities prior to having a spinal cord injury versus perhaps someone who's younger, who had more of a traumatic incident and that weren't on medications prior to having their traumatic injury. We know from our research, for instance, if people were on medications prior to their injury, if they had polypharmacy prior to the injury, they're likely to also experience polypharmacy post-injury. So certainly, I would venture a guess that people with non-traumatic spinal cord injury dysfunction likely experience more polypharmacy by virtue of the fact that they have a bit more medical complexity and they might be older.

Dr. Max Boakye:

What is the role of pain in all of this? How much of these polypharmacies are being given just to treat pain?

Dr. Sara Guilcher:

We did find in our research that opioid claims were quite common with this population. And so one would presume, then, that the opioids being prescribed for neuropathic pain and other pain-related symptoms. So this is an area, I think, for the spinal cord injury community as a whole to talk about in terms of what are the best practices for treating neuropathic and other related pain for spinal cord injury. And I know we have pain-related guidelines, et cetera. There's been more of a commentary discourse in the research community, with the editorials being written with different clinical opinions about whether or not opioids should or should not be prescribed for spinal cord injury.

Dr. Sara Guilcher:

Certainly, we found in our administrative health data that over a third of our cohort were being prescribed chronic opioids and high-dose opioids. So, for instance, we were looking at the recommended guidelines. The Canadian and the US guidelines are very similar in this regard, where they recommend for the general population that people are taking less than 90 morphine milligram equivalents. And we found that just over a third of our cohort were actually taking more than this and on a chronic basis. So there are some risks with opioid use, especially chronic opioid use, from a psychological and physical perspective. And so, again, these are conversations that I think individuals should have with their prescribers, and it should always be assessed on an individual basis as to what is

the best medication approach. Certainly, I think that it warrants further research into understanding what is the best way forward.

Dr. Max Boakye:

That's an extraordinarily high use of opioids. That's very interesting. What other drugs are commonly prescribed?

Dr. Sara Guilcher:

Yes. So as I mentioned, opioids we found are commonly prescribed. Also, benzodiazepines. Antidepressants we also found, and antianxiety medications, and laxatives as well. And this is where I just want to highlight where there can be prescribing cascades, for instance. So we know that opioids can cause constipation or contribute to constipation. And so there lies the challenge that eventually someone could be prescribed laxatives if they're also on opioids, dealing with constipation side effects. So again, it just speaks to the interaction that some of these medications might have on an individual and the importance of having review of medications and understanding what they're for and why.

Dr. Max Boakye:

I imagine, as you mentioned, there are good medications that are needed in spinal cord injury. How does polypharmacy impact the adherence to the good medications? And I imagine if somebody is taking so many medications, they may not be compliant with the good ones simply because there's just too many medications. Has this been studied?

Dr. Sara Guilcher:

Absolutely. It becomes a challenge. So it definitely has been studied in the general population, that we know that if people are experiencing polypharmacy, there's more challenges to being adherent, and so taking ... What we mean by that is taking medications as prescribed. As you mentioned, it becomes a lot more challenging if there's a complex medication regimen. So, for instance, if some medications have to be separated by a certain amount of time between others, some need to be taken with food and others not, it certainly can make it more difficult for people to manage that on a day-to-day basis.

Dr. Sara Guilcher:

We also recognize that there can be harms associated with people deciding to suddenly stop taking a medication, and that might need proper tapering. So there's a lot of different nuances that need to be taken into consideration when someone is taking medications, which again highlights why it's so important that we have more conversations about this, especially for people with spinal cord injury with their prescribers, so that their prescribers can understand the every day-to-day context for someone who's taking these medications.

Dr. Sara Guilcher:

In our qualitative interviews that we've done with people with spinal cord injury, we certainly heard in our interviews the challenges that people felt existed for them in terms of taking medications in the community. For instance, sometimes they didn't want to take it where they might be at work or they're around other people and fear of stigma, et cetera, or some medications are just easier to take when they're at home. Some medications need to be refrigerated, for example. It just makes things a little bit more hard for people to integrate into their day-to-day life. So I think that's an excellent point about it.

There are some really more ideal medications that people might be taking. And so the challenge is, when we add more medications to provide human, it makes it really hard for people to integrate that into their day-to-day life.

Dr. Max Boakye:

How reversible are these impacts? For example, do you know of any specific examples where improving the polypharmacy has led to an improvement in cognition or psychological profile of patients?

Dr. Sara Guilcher:

That's a very great question. I do know of an intervention that was done in the United States, actually, that was looking at de-prescribing opioids for people with spinal cord injury using an interdisciplinary team. And it was effective in terms of producing outcomes and reducing just opioids, not dealing with polypharmacy per se, but just reducing the taking of opioids. So to answer your question, I think that there are examples of positive outcomes in terms of how can we, in more of a formalized manner, reduce the medication-related burden for individuals? Certainly in the general population, this is done through common medication reviews. In Ontario, for instance, pharmacists can do a medication review and sit down and discuss with patients about their medication history about other concerns that they have with their medications and provide suggestions where they think that there might be some improvements in terms of making it easier for people.

Dr. Max Boakye:

So in your estimates, what percentage of drugs prescribing spinal cord injury may be unnecessary?

Dr. Sara Guilcher:

That is a great question. And that's something that I think we don't know yet in the research, and I think that's a really important area for further exploration. I think it really depends so much on the unique circumstances of the individual as well. It might indicated that somebody is on, for instance, 10 different drug classes, and perhaps it's not problematic because there's been clear education, counseling, conversations around goals, preferences, expectations, there's frequent monitoring, for instance, of the side effects, et cetera. So right now, we just really don't know about the percentage of drugs that are unnecessary.

Dr. Sara Guilcher:

Certainly, our key message from our research is that prescribers need to consider the individual benefits and risks for patients, and more importantly, people with spine cord injury be empowered to be part of the shared decision-making. In our qualitative research, we found that individuals with spinal cord injury were really fearful about issues around addiction, long-term negative effects, for instance, of taking a medication for, say, 10 years plus. And some medications, I mentioned, the regimen is so complicated that it impacted their ability to do daily activities outside of the home. So I think these concerns need to be explicitly addressed and on a perhaps minimum annual basis with prescribers, such that there's a frequent touching base about goals, preferences, and expectations.

Dr. Max Boakye:

When does polypharmacy generally develop? Is it mostly in the acute hospital or during the rehab? And is it more like one-year after injury or is more subacute injuries?

Dr. Sara Guilcher:

That is a great question, and again, I don't think we know the answers to it. So there's lots of great research topics for future research trainees and scholars. We really don't know a lot about this in terms of, when does this really start? Certainly, we know from our research that people who were prescribed when they were experiencing polypharmacy for their injury are more likely to experience it post-injury. So there's a previous history impact that exists. We know, for instance, that older adults, as I mentioned, are generally prescribed more medications. So we really don't know the answers to these questions.

Dr. Sara Guilcher:

I think where we could be looking at is, how can we think about opportunities in multiple touch points that we know people have within the health systems? So, as you mentioned, there's acute, there's rehab, and then people transition home. How can we provide education throughout all these different transition points about medications and empower individuals to know what their medications are for, ask more questions about their medications, be mindful about looking for side effects so that they are able to loop back with their prescribers about issues that they might flag.

Dr. Sara Guilcher:

And I think that there needs to be more funding for non-pharmacological treatments. So this gets more at a system issue, where certainly in Canada, there is sometimes more funding for medications, but less so for non-pharmacological treatments in the community. So for community-based physical therapy, for instance, or occupational therapy. And so if we're trying to think about a multimodal treatment intervention for individuals, it's hard for people to be able to privately finance some of these treatments, whereas their medications might be covered.

Dr. Max Boakye:

Very interesting. A lot of intricate questions. For example, the Canadian system is different from the US system. Do we have an idea of the comparative rates or magnitude of the problem of polypharmacy in both countries? Or, for that matter, in other countries like United Kingdom and other parts of the world? Is this a global problem or just a problem in developed countries?

Dr. Sara Guilcher:

Great question. Certainly, I'm aware of research ... Most of the research that we know on this topic area come from the United States and Canada. I would say that it's pretty comparable between Canada and the US. I think that it warrants a great opportunity for collaboration on an international scale, to look at rates of polypharmacy to spinal cord injury in other countries beyond Canada and the US. We've seen just globally a shift in medication use across countries, that there is more of a dependence on medications in countries that typically had not been reliant on medications in the past. So as people are developing in the general population more chronic conditions and multi-morbidity, we're seeing the prevalence of medications just increase globally. So I think it's also a cultural issue, so it's a larger issue than just an individual prescriber in terms of a global sort of reliance on medications when there's other non-pharmacological treatment options, but they're harder to deliver based on availability or costs or accessibility.

Dr. Max Boakye:

So I guess you would basically, if I'm to summarize, polypharmacy is a major patient safety issue. Would you agree with that statement?

Dr. Sara Guilcher:

Absolutely. And some other work that I've done not specific to spinal cord injury that has looked at hospital harm, and one of the areas of harm was medication-related issues that we identified using administrative health data. So it's definitely a patient safety issue.

Dr. Max Boakye:

We had thought that patient safety is often a system failure rather than individual failure. I'm wondering how true does this in polypharmacy? Maybe you can comment on whether this is more a problem of inadequacies or failures of the system versus the provider negligence or incompetence. Which is more of the problem?

Dr. Sara Guilcher:

I would echo that this is a system failure, and similar to what we know when there's ever quality or safety, it's typically a system failure versus an individual problem. And we need to think from a societal level, are there systems in place to flag if there's problematic drug attractions? For instance, do we have a repository where a patient's medication history is stored in one single record, that's accessible to all the different providers that are providing care for that individual in addition to being accessible to the patient?

Dr. Sara Guilcher:

Certainly, I can speak about in Canada, we really struggle with electronic health records. And so, for instance, even pharmacies don't communicate amongst each other. So if I go to pharmacy A to get a certain medication dispensed because it's close to my work, but then I go to another pharmacy because it's closer to my home, those pharmacies don't necessarily communicate to each other. So unless I verbally provide exactly what I've been previously prescribed, that pharmacist doesn't have any visibility to what I've been previously prescribed. And the same thing with prescribers. So certainly in Canada, we really struggle with prescribers having access to what other prescribers have prescribed. So that alone, I think, would help significantly.

Dr. Sara Guilcher:

When we had done some other research, looking at chart reviews and specifically looking at primary health care team and looking at records for people with spinal cord injury and just looking at how well the medication history was recorded, it was pretty obvious that it was really difficult to find a comprehensive medication history in these charts. And if a family physician doesn't have good visibility, if the specialists don't have good visibilities, the pharmacists don't have good visibility, it really puts the onus on the patient to provide very detailed information. If, for instance, a patient forgets to ... "Oh yeah, I was prescribed this medication," and that can happen when they're on multiple medications, there can be some serious drug interactions that are at play. So just that alone from a system perspective could make a big difference.

Dr. Sara Guilcher:

And then from an education perspective, how can we educate prescribers to be a bit more informed about person-centered care and the impact that might happen for someone with a spinal cord injury in taking these medications? So, for example, my master's student, Lauren Cadell, published her master's research, where she was interviewing people with spinal cord injury, and they talked about how it was really challenging from an identity perspective. Most people weren't prescribed medications prior to their injury, and then all of a sudden they're taking now multiple medications with a very complex regimen that really impacts their day-to-day lives with really difficult side effects that affect their ability to participate in therapy, and fatigue being a common side effect.

Dr. Sara Guilcher:

And so I think having sensitivity to this, for prescribers to understand that it's really difficult for some people to be conceptualizing themselves as someone taking medications, there's stigma around it, or they perceive there to be stigma. So having more sensitivity and empathy around prescribing, I think, would be a good change. And then thinking then about, how do we empower individuals with spinal cord injury with knowledge such that they're more informed, so that they're able to self-manage more and be empowered to speak to their prescribers about their preferences?

Dr. Max Boakye:

So let me summarize that. Let's say a rehab center, and most spinal cord injury patients get their chronic care in rehab centers. So let's say a rehab center in Canada, or for that matter, anywhere in the world, they decide this year they want to improve the population health of the patients. And one of their focus is polypharmacy. What are sort of like five things that you would recommend, five steps that you recommend will give them the biggest bang for the buck?

Dr. Sara Guilcher:

Personally, I think that every patient should have a proper medication review, such that the prescribers can look and critically think about, are these medications necessary? How impactful would it be for a patient? Having a conversation and a shared decision-making approach with patients to talk about pros and cons for each medication and also the costs associated with these medications. So that's something that I don't think we've talked about yet, but that's significant. And work by Dr. Gupta in Canada has recently highlighted that cost-related non-adherence is quite problematic for people with spinal cord injury as it is for the general population as well. So I think costs need to be taken in consideration for people to understand how are they going to be able to pay for these medications on a long-term basis, especially if that's the plan for them to be taking these medications for quite some time. So that's the first thing that I think needs to happen.

Dr. Sara Guilcher:

The second thing I think, in a rehab facility especially, is so much has done on education about transferring, doing activities of daily living, instrumental activities of daily living, and so much great work is done there. But when we talked with individuals in our interviews, they actually mentioned that they had very little interaction with pharmacists and they had very little education and training about their medications, and they found it quite overwhelming when they were discharged home. So I think having more formalized education in a rehab setting would be very important for patients to empower them and also build their confidence to watch out for side effects, to think about the benefits of their medications, to practice even in a rehab setting, how would one take these medications? Sometimes

there's physical challenges as well in terms of taking medication. So thinking through all of these various pieces so that it minimizes some of the barriers once people transition to the community.

Dr. Sara Guilcher:

Thirdly, I think that having ongoing support once people are discharged home is really important. So encouraging patients to only see one pharmacy, and that encourages the concept of usual provider of care and creating continuity of care. So we know that more errors happen the more different people are involved in one's care, particularly if there's medications that are being dispensed across different locations but don't have visibility with electronic health records. So trying to educate patients and encourage them when discharged home to seek one pharmacy as much as possible and develop a relationship with that pharmacist. So in Canada, for instance, pharmacists are incredibly accessible to the public. Often there's physical accessibility and you don't need to make an appointment. And pharmacists are one of the healthcare professionals in addition to physiatrists and other specialists who really understand the interactions of medications. So really leveraging pharmacists' expertise with that would be really beneficial.

Dr. Sara Guilcher:

I think the fourth thing would be creating some sort of peer support model so that when people are discharged home, that they have people that they can talk to who have similar lived experience. We have lots of peer support models for general self management, but I don't think, to my knowledge, a lot exists around medication self-management. So I think that would be a key thing to work on.

Dr. Sara Guilcher:

The fifth thing, I think, is general education for prescribers. A big challenge, certainly, we've seen in our interviews with some prescribers in the community is that they're not specialists in spinal cord injury. So if we could have some sort of more formalized relationship that can happen between the rehab facility and prescribers in the community such that there's a go-to resource, there's almost clinical coaching for physicians, particularly family physicians, who might not have the clinical expertise and the specialization to understand the nuances and the complexity with spinal cord injury, if we could have some sort of clinical mentoring models established, I think establishing those five key areas would, I think, make huge improvements.

Dr. Max Boakye:

That sounds good. That's five topics. When I put the show notes on this topic, I may have you add some additional ones and I can put on the websites for others for more information. By the way, for audience that wants more information on this topic, where can they get more information?

Dr. Sara Guilcher:

If you want more resources to the research that my team has done, if you go to guilcherlab.com, so it's www.guilcherlab.com, we have a whole list of different resources there. We have infographics. We have YouTube videos describing our research. We have links to our papers. A lot of our papers are open access because we really try to give back to the community so people can read our research. And if you ever have any questions, you can reach out to me or to any member of my research team and we'd be glad to have a conversation.

Dr. Max Boakye:

Great. Now for my final question, my magic wand question. So if you have a magic wand, what questions would you like answered? How would you fix this problem? What would you see happening in the next decade?

Dr. Sara Guilcher:

Yeah, in the next decade, there was a couple of things that I'd love to see. I'd love to see more funding and access to non-pharmacological treatment options that could complement pharmacological treatment. I think that there's a place for both, and I think it would be really wonderful if we could have more funding for both. So we know that cost-related non-adherence exists. And so if there's more funding to support people paying for their medications as well as more funding and support for other therapies, such as physical therapy and occupational therapy and exercise therapy, I think that would be an amazing accomplishment.

Dr. Sara Guilcher:

If I had a magic wand, I would love to have more formalized education, more toolkit-like interventions with peer coaching for people with spinal cord injury around medication self-management and more clinical coaching models for clinicians, such that clinicians in the community in particular feel supported. We have amazing expertise internationally on spinal cord injury, and it would be amazing if we could formalize more mentoring, such that this knowledge and expertise could be shared just to support some of the clinical decisions that non-experts need to make with their patients.

Dr. Sara Guilcher:

Finally, I think if we had more person-centered care around the patient's goals and expectations with respect to their medications, recognizing that there could be opportunities for de-prescribing around issues like prescribing cascades. And if we can just take a bit more of a critical, mindful eye about what people are taking and why, and really assess the risks and benefits for everyone, I think we'd be in much better shape.

Dr. Max Boakye:

Thank you very much, Dr. Guilcher. This has been really a fascinating introduction to the problem of polypharmacy. Thank you for informing me and the audience, and we'll direct them to your websites for more information. Once again, thanks very much.

Dr. Sara Guilcher:

Great. Thank you very much for inviting me. It was a pleasure.

Dr. Max Boakye:

Thank you.

Narrator:

Thanks for listening to Optimal Neuro|spine podcast with Dr. Max Boakye. If you enjoyed this episode, we hope you share it with others. Leave us positive reviews on social media or leave a rating and review on iTunes. Check out our website, MaxwellBoakye.com/podcasts for show transcripts and other information. Join us next time for another edition of Optimal Neuro|spine show.