

# YCBS1E4 - The quest to solve the concussion problem

Tue, 4/26 11:27AM • 41:57

## SUMMARY KEYWORDS

concussion, people, brain, CTE, symptoms, Alzheimer's, Chronic traumatic encephalopathy, Rowan Stringer, suffering, injury, research, multiple concussions, patients, cases, dementia, disease

### Heather 00:00

[Your Complex Brain theme music] This is Your Complex Brain, a podcast all about the brain, the diseases that impact it, and the path to finding cures. I'm your host, Heather Sherman, and I have the great pleasure of working alongside the team at the Krembil Brain Institute in Toronto, Canada, a leader in brain research and patient care. In each episode, we'll take you behind the scenes into our clinics and our research labs to meet the game changers of the future, and we'll empower you with the latest research to help you take charge of your own health. You'll also hear directly from patients who are living with brain disease, and the care teams who support them. Join us on a journey to unravel the mystery of your complex brain. [theme music continues then fades out]

### Reporter 1 00:59

[news hit music] Some sobering news this weekend from the NFL former Arizona Cardinals linebacker Kylie Fitz announcing he is stepping away from football at the age of 27. In an Instagram post, he writes, "After 21 years of playing football, football has come to an end for me due to too many concussions and the severity of my recent one, it is no longer safe for me to continue to play." He goes on to say, "I am so grateful for this game and everything it has brought into my life."

### Reporter 2 01:05

[rhythmic electronic music] For 10 years, he tore up the ice and terrorized opponents as an enforcer of the NHL, even winning two Stanley Cups with the Blackhawks and earning the nickname "Car Bomb".

### Reporter 3 01:17

Today, he says he's living with brain damage and continues his battle, now off the ice, to fight for brain health, transparency, and greater awareness when it comes to the great debate over concussions. [music continues]

### Heather 01:35

The stories are everywhere. Concussion is on the rise, and the consequences can be deadly.

### Reporter 5 02:02

[gentle electronic music] It's a very personal topic for them. I want to introduce Kathleen and Gordon Stringer. They're the parents of Rowan Stringer, a 17 year-old young woman who passed away earlier this year after she suffered a concussion while playing rugby. Take us back to that day.

**Gordon** 02:25

The only thing that we have is what's been told to us, but, apparently, there was a rough tackle. It was a penalizable tackle, and she, apparently, was airborne for a little bit and, basically, landed on the ground with her head and her neck taking the brunt of the force. We're told, apparently, she sat up, momentarily, kind of raised her hand to her head, and then lost consciousness. And, she never regained it.

**Kathleen** 03:06

It's very sad. It changes your whole life completely, never to be the same again.

**Heather** 03:06

[gentle music continues] Rowan Stringer was a 17-year-old, high-school rugby player who dreamed of being a nurse. She died in 2013 after sustaining multiple concussions over the course of several rugby matches. Five years after Rowan's death, with support from her family, Rowan's Law was passed, building a foundation for increased awareness around concussion safety. [gentle music fades out, upbeat electronic music plays] Thanks to Rowan's Law, schools and sports teams are now legally required to remove students from a game, who have either sustained a concussion or who are suspected of having sustained one. This law is going to save lives, and it's an encouraging step forward for concussion education and advocacy. Now, it's time for research to catch up. There is currently no way to accurately diagnose a concussion or predict the length of recovery, and there are no effective treatments. With concussion, there continues to be more questions than answers. Fortunately, Dr. Carmela Tartaglia is on the case. She's a cognitive neurologist and a clinician investigator at Krembil Brain Institute, and she also co-leads the UHN Memory Clinic. Dr. Tartaglia's research looks at the link between multiple concussions and neurodegeneration, or progressive loss of brain function. Neurodegeneration is often present in diseases such as Alzheimer's and Parkinson's. Thank you so much for being here. [music fades out]

**Dr Tartaglia** 04:33

Thank you for inviting me.

**Heather** 04:36

Well, we have a lot to dig into today. Concussion is a huge and important topic. We just heard about Rowan Stringer in the intro to this episode. So, how has Rowan's story highlighted the dangers of multiple concussions?

**Dr Tartaglia** 04:47

What Rowan highlighted in her, you know, tragic end, I think, is how devastating a concussion can be. You know, "concussions" and the words "mild traumatic brain injury" are used interchangeably, and they don't mean exactly the same thing, but I think using the word "mild" is kind of a misnomer when you end up as Rowan Stringer did. You know, she suffered a number of concussions over a short

period of time. They were unrecognized by people who could have, maybe, brought her to medical attention. She didn't even really recognize them herself, and so, you know, we now know that a person who's had a concussion, and suffers a repeated concussion shortly thereafter, there are some people who are at risk of what we call a "second impact syndrome," and that can lead to death.

**Heather** 05:44

So, let's back up for just a second. What is a concussion, exactly? What's happening to the brain?

**Dr Tartaglia** 05:49

When people come to me with persisting symptoms of concussion, one of the things that I hear often is, "I'm not the same person." You know, "People tell me that I've changed," and I think it's really important to recognize that the changes that occur after a concussion is because of the injury to the brain. It's not a major injury, but it is an injury to the brain, where things changed. It's not that there's, like, a structural damage so that you could see the damage, but the biomechanical forces that impact the brain caused some changes, at a very - let's say cellular level - and those changes produce the symptoms that you have. So, you know, people get a concussion, and they end up with a headache, or concentration problems, or mood disturbance. Well, those things happen because there are changes in the brain, and those changes, even though we can't see them with our imaging, even quite sophisticated imaging in some cases, still, the symptoms that you get are symptoms that belong to the brain. So, you know that, fundamentally, something has happened to the brain. Doesn't mean that it's permanent. You know, we think of concussion as a transient change, but the symptoms you get are from changes in the brain.

**Heather** 07:16

So, is that what makes it so challenging to detect and diagnose a concussion?

**Dr Tartaglia** 07:20

Yes. We're really good at diagnosing things that are pretty significant, right? And, when you think you have, like, millions of neurons, cells in your brain, you know, millions and millions of axons, so these are the connections, and really, a concussion is kind of like this -- you know, we think of it like this jiggle effect through your brain. And so, you know, things stretch a little and move a little and, although nothing is destroyed, per se, like a moderate or severe brain injury, but there's enough damage, enough jiggle effect, let's say, that you end up with consequences that show you that the brain has been impacted. So, that's when, in terms of like concentration problems, people sometimes become very emotional after they've had a concussion. They cry for no reason, or they feel like they can't process visual information properly. All that comes because of this, you know, though "mild," you know, in quotations, but it's still an effect on the brain. [gentle, electronic music]

**Heather** 08:28

Well, I know that a lot of your research focuses on this post-concussion syndrome, so you see patients who are still suffering from symptoms, months and even years later. So, how would a typical patient, with post-concussion syndrome, present?

**Dr Tartaglia** 08:41

You know, I think, as a field, we're trying to move away from the words "post-concussion syndrome" because it doesn't meet the criteria to call this a syndrome. As well, we're optimistic that most people can get better, and so we think more along the lines of prolonged or persisting symptoms of concussion. The issue is how to make the diagnosis, when to make the diagnosis. I mean, you know, you think it's so easy, right? Like, usually when something's wrong with you, you go to your doctor, and they do a few tests, and they diagnose you. And, in concussion, it's difficult because, you know, we go by, "Well, you had some injury that impacted your brain." In some cases, it doesn't even hit the head. It could be other parts of your body that get a severe, very strong force applied to it, and that force is transmitted to the brain. So, an injury happens, something happens, and then you develop the symptoms right after, usually within seven days, we expect the symptoms to appear. And, it's all clinically diagnosed, so you have these symptoms, they happened after this injury, and so, by definition, you have persisting symptoms of concussion. When does it become too long, right? You know, we don't heal the same way. Like, if you get a cold, and I get a cold, it doesn't take us the same amount of time to heal, so when is it abnormally long? And, that definition, actually, is in flux. Until a few years ago, you had to have symptoms for three months to say you had prolonged symptoms, and now, we think of, you know what? Within two weeks, you should be getting better, and if you're not getting better within two weeks, we should start thinking about actively treating you. And, that doesn't mean necessarily just with medication, but it means that we have to be alert to certain symptoms that you may be experiencing, you know, maybe get you hooked up to see different professionals who deal with concussion, but we don't wanna wait three months before we make referrals, before we start thinking, "Yeah, this is too long for your symptoms." So, as you can see, it's quite fluid, right? It's not as well defined as other things, and I've already mentioned that you can't see anything in the brain, per se, you know, with imaging, even MRI, so it becomes, how do you try to make a diagnosis so it encompasses all the various symptoms a person can have after a concussion? There's, like, can be 50 different symptoms, and so, you can imagine how heterogeneous this group is. We have shown that, actually, not every person with a persisting concussion symptom is the same, right? First of all, you can have any compilation of different symptoms, so some people will have a headache, and nausea, and dizziness, and vertigo, and another group will have, maybe just, you know, mood problems and anxiety, and some post-traumatic stress disorder, and another group could have, you know, only concentration issues and memory problems. So, you know, very heterogeneous, which makes it very difficult when you're trying to make a diagnosis. Also, when you think of, you want to treat people, when we create clinical trials, we want the groups to be as homogeneous as possible, and here, we're saying, "Oh, wow, you can have 50 different symptoms, and any combination [chuckling] of these symptoms."

**Heather** 12:22

It's the exact opposite of homogeneous, in this case.

**Dr Tartaglia** 12:25

Yeah. So it's very difficult, and so, that's why, we really are, you know, in concussion, at least in my clinic, we're really trying to move towards precision medicine and personalized medicine, because you and I will not experience a brain injury in the same way. And so, we'll have different symptoms that we have to deal with. We have different contexts, and so we try to move towards, you know, individualized treatment.

**Heather** 12:53

I guess that's the future.

**Dr Tartaglia** 12:54

Yes. One would hope.

**Heather** 12:56

I was always wondering, Why do some people tend to recover more quickly from a concussion than others?

**Dr Tartaglia** 13:01

That's the million-dollar question, right? Because there are people who have many, many concussions. I see former professional athletes, and some of them are in their seventies and eighties, and have had many concussions, and they are doing fine. And then, I have people who have had one concussion and, you know, by all perspectives, it seems to be relatively benign. You know, like they hit their head on a cupboard, or they bent down under their desk, got up, so you expect that it's, you know, usual injury, many people have those injuries, and yet, they become debilitated. And so, we do think that there's probably some genetic component. You know, people talk about red flags and having certain past medical histories that, maybe, put you at higher risk of having prolonged symptoms, and we're, actually, actively studying that. So, you know, one thing that keeps coming up over and over again, is gender and sex. It seems women are at higher risk of suffering a concussion, and then, at higher risk of more persisting symptoms of concussion so, you know, we take that into consideration. And then, you know, past medical histories of mood issues, or things like active depression or anxiety seem to put people at risk, so there's many different factors that have been listed. When you look at the literature very closely, you realize that, actually, it's not as definitive as you would like, you know? It's not as cut and dry, and, you know, I have many people in my clinic who were never sick, never had an issue before their concussion, and they are a year out and they can't get back to work, and they can't get back to their lives. [gentle electronic music] So, we don't understand. There's still so much more research to do here.

**Heather** 13:55

Well, you mentioned working with professional athletes, or former professional athletes. That's something that we also hear a lot about in the news, is chronic traumatic encephalopathy or CTE, big focus of your work. So, what do we know about CTE and what it does to the brain? [music continues]

**Dr Tartaglia** 15:04

Yeah, so CTE is what we call now a proteinopathy, or a neurodegenerative disease. So, CTE, like Alzheimer's disease, like Parkinson's disease, involves the buildup of these abnormal proteins in your brain. So, you have these proteins who, you know, start off being normal, having essential functions in your brain, for some reason become abnormal, and start building up in different parts of the brain and, actually, are toxic to the cells. And so, they cause cell death, and CTE happens to be what we call a tauopathy, so buildup of abnormal tau. It looks a lot like Alzheimer's disease tau, but in slightly different areas, so they're not exactly the same. And, what ends up happening is that, you know, this disease, it's thought to start years later, after the last concussion, and slowly builds up over time. [music stops]

And then, people end up with, like, behavioural changes. Those are the ones you hear about, right? Many people who have CTE, they have a dementia, this umbrella term that basically encompasses all of these neurodegenerative diseases. It's not like people come into your clinic, and they have a label on them, that, "I have CTE." They have cognitive symptoms, and some of them, just memory, some of them, you know, memory and behaviour and motor. And then, when we do an autopsy, we can say if you have CTE. CTE is not diagnosable while people are alive. That is a main focus of my group and the Canadian Concussion Centre, is to really try to find a marker that can tell you that you're starting to accumulate this abnormal tau in your brain, and the hope would be that, if we could diagnose you early enough, when you're still doing okay, then we could stop it. You know, we could give drugs to stop the buildup, and then hopefully prevent you from developing dementia.

**Heather** 17:00

How far in the future do you imagine that that research could be realized? What's the status of your research into that, currently?

**Dr Tartaglia** 17:06

I don't think we're so far off. We have some really nice data that this PET-ligand we're using. So PET stands for Positron Emission Tomography. It's a kind of imaging where we, basically, will label or tag certain abnormal protein, and we inject that into you and, if it finds a match in your brain, it would stick there, and then, when we take pictures, it will light up and we would know that you have this in your brain. So, we use this in Alzheimer's disease, and we can also, you know, investigate its use for CTE. And so, we'll be able to, hopefully, you know, in not-so-distant future, see whether it will be useful. We have a blood test that we do to indicate that there's some neurodegeneration, so something bad going on. We can do lumbar puncture. So, right now, we have enough data that there are people who seem to be vulnerable, so they are normal in terms of their functioning well, but they are starting to accumulate this in their brains. And so, we hope, you know, whenever you develop a test, whenever you develop anything, you have to validate it. And so, right now, we're still in that kind of phase where, you know, we need, like, autopsies to validate that, "Yes, we found this in the person while they were alive, and it actually correlates to this, once they've died." So, we're at that phase, and we don't think that we're so far off.

**Heather** 17:10

That's exciting.

**Dr Tartaglia** 18:42

Yeah. I think, you know, that will definitely be a huge step forward for people because we are moving towards these monoclonal antibodies. So, monoclonal antibodies are, basically, this new type of drug where if, let's say you have some abnormal protein in your brain, like, let's say, amyloid, in the case of Alzheimer's disease, because that's the one that's most well-known, basically, if we give you this drug, if it finds the amyloid in your brain, it tries to take it out of the brain. [gentle electronic music] And so, we could actually try, in CTE, but you'd have to first diagnose the right person to put into the trial. [music continues]

**Anna** 19:33

My name is Anna Vasilevskaya. I am a fifth year PhD student in Dr. Carmela Tartaglia's lab at the Krembil Brain Institute. When I came upon the research that was being done by Dr. Tartaglia, and I thought it was very fascinating to look into the field of chronic traumatic encephalopathy because, right now, it is not known who develops chronic traumatic encephalopathy, people of different ages, of different sexes, from different sports, and different number of concussions, and it is still not known what contributes to that diagnosis. And, I thought, "It would have been so amazing to be at the forefront of that discovery." In Dr. Carmela Tartaglia's lab, I am looking into different signals, or markers, that the human body has, that can tell us, or clinicians, hopefully in the future, who is on the way to develop chronic traumatic encephalopathy, or who potentially already has it. This would be a way for us to measure and improve, kind of, patient diagnosis and prognosis. As well, this will guide future clinical trials, so what I mean by that is, if a treatment is discovered, if we're able to find that signal, be it in the blood, cerebrospinal fluid, maybe somewhere else in the body, it will be able to tell us that, for example, this person has elevated signals, so then we will pay a closer attention to this person, and if they undergo the treatment, we will be able to measure, over time, if that signal is improving. And then, if that signal is improving, we would be able to tell the treatment is working. Right now, currently, there is no such signal or marker that exists that we can use while the patient is still alive, and unfortunately that limits how we go about diagnosing this illness. [electronic music] I really wanted to work with Dr. Tartaglia, specifically, because of how much she's able to bring into the scientific community. What I mean by that is her extensive knowledge of concussion and being, like, at the forefront of chronic traumatic encephalopathy research is really what drew me to this lab. And, she works very closely with the athletes to advocate for them, and so, we not only have an impact on kind of understanding the pathophysiology of the disease, as well as improving the treatment, but you're also working directly with the patient to see what they need, how you can better support them. It would make me feel very honored and thankful for all the hard work that is being done by all the amazing, accomplished researchers that, if one day, we're able to find those markers, we're able to find those signals to help us better diagnose chronic traumatic encephalopathy, and hope that one day we're able to find, and even maybe treat it successfully, which would be the absolute amazing end goal. [music fades out]

**Heather 24:09**

In a previous episode about Alzheimer's, Dr. Donald Weaver mentioned concussion or brain injury has now been identified as one of the 12 modifiable risk factors for dementia. So what's the connection there?

**Dr Tartaglia 24:20**

Yes, and, you know, that's a big concern now because, until recently, there there was this ongoing debate because, when you look at the large datasets that we have, traumatic brain injury was associated with what we call neurodegeneration or dementia, and the thing is that, in many of these cases, we thought of moderate or severe traumatic brain injury, which makes sense, because in moderate and severe traumatic brain injury, you actually have changes to the brain. So, of course, you would expect, well, that's not going to be good for you, and, you know, we all know that, as we age, our brains shrink, so you could imagine something like that is going to give you a head start, like extra shrinkage. But, the novelty of the 2020 report was that mild traumatic brain injury, or concussion, was added to that list, so even one concussion was associated with a higher risk of dementia.

**Heather 25:24**

One concussion.

**Dr Tartaglia 25:25**

One concussion. You know, obviously not as bad as having multiple concussions, and obviously not as bad as having a moderate or severe brain injury, but even one concussion was associated with an increased risk. The issue becomes that, with these kinds of studies, it's very difficult right? Because, no matter what, there's a recall issue. I have to say, you know, you mentioned I'm a cognitive neurologist, and I see people with dementia, and it's become much more common now for people to tell me about, you know, when they fell, and they were five years-old, they fell off their bicycle or, you know, had some injury, and, you know, 10 years ago, nobody mentioned that. So, now we're starting to recognize that maybe even one concussion is not good for the brain. All this has to be looked at. We expect that people who've had more significant concussions are the ones who come to our attention, because they're the ones who actually recognize they've had a brain injury, even if it's mild, and then they have some symptoms that persist. We also don't know very much about the genetics of concussion. We've looked, in our work, at one of the markers that we see in Alzheimer's disease that puts people at higher risk of Alzheimer's, and, you know, notice that, in this older population of former contact sports athletes, if you had this marker, this APOE4 gene version, let's say, that you're more likely to accumulate some abnormal tau, as we measured it with this PET-ligand. So, you know, it's just all this to say that we just need a lot more research. We are aware that the only risk factor for CTE right now is repeated concussions. [gentle electronic music] Now, for dementia, obviously, concussion and brain injury is only one of 12 risk factors, right? And there's other ones, you know, that are also modifiable. So there, the relationship is less. [music continues]

**Heather 28:09**

But, there have been cases of misdiagnoses related to CTE, right?

**Dr Tartaglia 28:14**

Yeah. So it's becoming a really big problem because, you know, I think people need to understand, today, you cannot make a diagnosis of CTE while a person is alive. You can wonder about that. So, I have many, you know, former professional athletes who've had many concussions. They're in their sixties, seventies, even eighties. They're having cognitive complaints. They're telling me their memory is different. Their families will say their personalities are changing. And so, you can presume there might be CTE. So, you could put it on that list of differential, you know, the "differential diagnosis", we like to call it. And, on that list, you will also put the more classic neurodegenerative diseases like Alzheimer's, or frontotemporal dementia, or Parkinson's disease dementia, like other ones, and then you would say, "Possible." Right? But, you would not give that person a diagnosis of CTE because you can't. You can only do that once they've died. And, you know, we've had some cases where people have maybe not been as actively treated as they should have been because they were presumed to have CTE, and we all know CTE is not a treatable condition. Whereas, you know, they ended up having significant psychiatric disease, and, you know, in some cases, committing suicide or undergoing MAID, which stands for Medical Assistance In Dying. And so, we really have to be careful about this, you know, and we're working very actively in our research program to find a marker to be able to say to somebody, "Yes, this is what you have," because, although it's not a great diagnosis, you know, it's not

like people come to us because they have nothing better to do. They come to us because something has changed about them, and either they've noticed or somebody else has noticed or, you know, many people have noticed, and so they want an answer. "What has changed?" You know, when it's your personality, or your cognition, I mean, your brain has changed.

**Heather 30:17**

And what's life like for some of these patients? I mean, you hear their personal stories when they come in to you. What is life like for them, and how has it changed?

**Dr Tartaglia 30:25**

So, you know, let's talk about the patients who are at highest risk of CTE, which are these former professional athletes who were in contact sports. Those people, you know, played a game that they loved, but many of them played it at a time where people did not recognize that, you know, it could be actually detrimental to your brain. And so, some of them say, if they would have known, they wouldn't have played. Others say, you know, the sport really defined them, and so they would have played anyways. But, you know, I think the the issue is that, now, they're post- that time, right? Now, they're just living with the changes that are occurring and the worry, the anxiety that they have this neurodegenerative disease, building up in their brain as a consequence of something they did, like, 20, 30, 40, 50 years ago, in some cases.

**Heather 31:25**

Right. And, at that time, concussion was considered almost trivial, almost a rite of passage in some of these sports, right? So, what needs to change? I mean, obviously, a lot has changed since then, and then we've got Rowan's Law and other advocacy efforts, but what still needs to change in the field of concussion?

**Dr Tartaglia 31:41**

I think people need to realize that, you know, you are defined by your brain. I mean, it's not very romantic, but your brain is who you are. Your brain is what loves, your brain is what hates, your brain is what makes you like blue and not green. So, when your brain changes, you change, and, you know, you only have one brain. If you do not expend any energy taking care of it, you probably won't have a well-functioning brain late in life. And, you have to remember our lifespan now is, you know, 85, 86, 87 years old so, if you don't take care of yourself the whole of your life, then there's not going to be very much to take care of, later on.

**Heather 32:54**

I think there might be a lot of people listening right now thinking, "You know, wow, that fall I had last year, maybe I had a concussion, and I didn't even know it." So, what is the most important thing that you want people to know about concussion to better protect themselves?

**Dr Tartaglia 33:08**

I think, you know, falls, hits, all that kind of stuff happens. I mean, we want people to be active, so the more active you are, you know, the more likely it is that something can happen to you. Most of us, if we have some fall or some injury, we recover. And, I think today, we think that's fine, and we're gonna be

okay. You know, we have some resiliency built into us. We aren't woodpeckers, [chuckling] but we're also not, you know, made of crystal, and we're not gonna fall apart at every little thing. But, if you do have symptoms afterwards, like, let's say you do have a fall, and then you develop a headache, and, you know, maybe you can't concentrate as well, and you're not sleeping as well, then that needs to be brought to medical attention because, A, there are treatments that we can help you with that. B, we really want you to take care of yourself because we wouldn't want you to suffer another concussion while you're still trying to heal from this one. And, C, it affects you, and it affects the people around you, and it affects your work, it affects your school so, of course that needs to be taken care of and taken into consideration, so you might need accommodations. There has been a lot of change in our society, in terms of making accommodations for people who have persisting symptoms, but still, I hear of people who, they didn't even recognize that, you know, a concussion they had, like, five years ago was actually a concussion, and that there were some consequences to it. And so, you know, their performance at work kind of declined afterwards, and, you know, they didn't get the promotion that they were looking for, or things change, but nobody had recognized it. [gentle electronic music] So, I'm hoping that people do recognize that people can have consequences to a hit to the head, and that we can help with a lot of those symptoms, and helping with those symptoms can, many times, get people back to their baselines.

**Heather 35:21**

You mentioned returning to work and accommodations, and I thought I remember you talking about a prediction tool that you're collaborating on right now. Is that something you can tell us about? [music continues]

**Dr Tartaglia 35:30**

Yeah. So, we're working on a project through the Canadian Concussion Centre, actually, in partnership with the WSIB, and Altum Health, and this is really about creating a tool that will help us predict who is more likely to not recover as quickly as we would like. And the reason for that is that we would like to target that person with, maybe, a different combination of therapies, maybe get to them a little quicker, and so, the hope would be that, if you can, first of all, personalize the therapies, but also modify them in a way that-- you know, when you think of therapies, there's like Cadillac therapy, Cadillac treatments, right, where you would get everything? But actually, in our healthcare system, that isn't possible for everybody to get everything, nor is it warranted, and nor would the person who's healing well want them, right? Because, no matter what, when you think of therapies, they're all time-consuming, and you gotta put in the work. [music fades out] But, we would like to identify the people who need those therapies, need them more promptly, so we'd like to get the right therapy to the right person, and this tool will hopefully help us identify, "Who are those people who really need this Cadillac version of the therapies?"

**Heather 36:50**

And, how much more improved could outcomes be, once we personalize medicine in concussion?

**Dr Tartaglia 36:56**

I think they could be greatly improved, because there's recent data to show that there are many people who have symptoms that outlast that two weeks, three months, even. So, you know, in Ontario alone,

the studies show there's over 150,000 concussions, and these are only the ones that, like, interact with a medical system, right? That's the only way we can identify them. So, there are 150,000 a year. So, even if you were super conservative about the number of people who have persisting symptoms, the low end is about 10%. That's a lot of people per year. The high end is, like, you know, probably closer to 30, 40, 50% at one year. That's a lot of people still struggling with persisting symptoms of concussion, right? And so, yeah, some people can get back to work, some people can get back to school, not functioning optimally, but, you know, still get back, but there are still quite a few people there who actually can't do most of the activities they used to do. And, even when they're, like, at home, they cannot assist their families the way they used to. Those are the people that we're hoping we'll be able to identify and intervene, in some way, to get them back to their baseline function.

**Heather** 38:20

Do you think that concussion is still as misunderstood as it once was? Or do you think that's getting better?

**Dr Tartaglia** 38:25

I definitely think it's gotten better. Recognition of concussion in sports has gotten better. But, you know, in some areas, we haven't made as much headway as we'd like, right? Intimate partner violence is one of those areas where it's very much under-recognized, the amount of head trauma that some of these people are suffering. And, you know, when you think of multiple head injuries in a sport, it's not that dissimilar to what some of these people are suffering in intimate partner violence that can go on for years. And that doesn't even include all the psychological trauma that they're suffering. So, yes, in some areas, I think we have made some headway. In other areas, less so. And, I still think that there needs to be more education around the idea that, you know, "This is your brain and, if your brain changes, you will change."

**Heather** 39:22

What do you love about your job? Last question.

**Dr Tartaglia** 39:24

I love that my job allows me to be curious and to ask a lot of questions. I feel very privileged that I get to work with patients and, you know, you, in some cases, get to help people make a full recovery. In many cases, you get to help people - not in all cases, but in many cases - and so, I feel very privileged that I get to do the kind of science that takes me from the bench to the bedside, and back to the bench. And so, my questions come from my patients, and my research, I can bring to my patients, so I feel very privileged to be where I am, and in the position that I am.

**Heather** 40:29

It's the best of all worlds.

**Dr Tartaglia** 40:31

Yes, I think so.

**Heather** 40:32

[Your Complex Brain theme music] Thank you so much, Dr. Tartaglia. This is absolutely fascinating, and we learned a lot. Thanks a lot.

**Dr Tartaglia 40:39**

Thank you for having me. [gentle electronic music plays]

**Kathleen 40:52**

It's been such a difficult, sad, never-ending journey. We would never want another family to experience this. And that's the real driving force. That's why we go and tell Rowan's story. [music fades out]

**Heather 41:11**

[Your Complex Brain theme music] This episode of Your Complex Brain was produced by Jessica Schmidt. Executive Producers are Tobin Dalrymple with Pilgrim Podcasting, and Carly MacPherson, with production assistance from Dr. Amy Ma, Twayne Pereira, and Suzanne Wice. If you enjoyed what you heard, tell your family and friends, and leave us a rating and review on your favourite podcast listening app. Thanks for listening. We'll be back in two weeks with another exciting episode. Have a great day. [theme music fades out]