

# Women and Stroke: How Sex and Gender Can Affect Your Cardiovascular Health

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**Transcript**

## **[0:00 Introduction and overview]**

*Dr. Ada Tang:* Did you know that there is one new case of stroke every five minutes in Canada? It is a significant health issue, not just in Canada, but globally. And while stroke was thought to, believed to be a condition of aging in older adults, one in four cases are in people that are under the age of 50. Mortality rates are dropping, and disability from stroke is increasing. So, we need to, hopefully from today, we would be able to shed some light into some of the research that we're doing in stroke at McMaster, and particularly around stroke in women.

There was a slide just before just showing you just a picture that I had taken last weekend in a conservation area that's close by to the University. I thought it was very timely to share this with the talk today because I was amazed at how beautiful the conservation area and the trails were at this time of year. It was covered in different ground flowers, in different growth, and all the new growth that comes in the spring. And I was amazed at just these flowers here growing together with other flowers, growing together with trees, and growing together with a lot of the life and the creatures that are waking up in the forest. And we had a lovely land acknowledgement shared earlier today, and with the Dish with One Spoon Wampum Agreement and the agreement to share peaceably with these lands and our commitment to really protecting the lands that have been protected by the Indigenous people of the lands for so long. I think it also reflects a bit of what we wanted to share today, that it's diversified diversity in research that will give us the best ideas and the best insights into how to treat conditions like stroke.

So, what is stroke? There are two types of stroke. One is where there's a blockage of blood flow in the brain, and that's usually caused by a blood clot that will travel up towards one of the arteries in the brain and block blood flow to the brain. And this type of stroke is called an ischemic stroke, and is by far the more common type of stroke. About 80% of strokes are ischemic strokes. The other type of stroke is what we call a hemorrhagic stroke, and this is also a disruption of blood flow to the brain, but instead, an artery ruptures and bleeding happens into the brain tissue and disrupts brain function. This is about 20% of stroke. So, there are two types of stroke. And so, you might hear about these two. Both of them can lead to disability and long-term impairment after stroke. And both of them will have different medical treatments. But in terms of rehabilitation, a lot of the things that we would be working on as physiotherapists and other health professionals would be very similar.

Now, as I mentioned before, the cases of stroke are rising. In 2015, it was estimated about 400,000 Canadians are living with stroke. Within about 20 years, it's almost going to double, and it is projected to keep going up from there. In addition, the risk of recurrent stroke is also high. So once somebody has a stroke, their stroke risk is 26% within five years of that first stroke and 40% within 10 years. So, having one stroke can increase the risk of another stroke, and that's of concern to us. And the other thing is that 56% of people with stroke around the world are women. So, stroke is a condition that affects both men and women, almost equally, in fact, a little bit more in women.

On the next slide, I'm going to show you a graph that shows the rates of death due to stroke across the lifespan. So, different age groups across the bottom, and then as you age, you can see that the bars are growing, which means that the risk of the number of deaths due to stroke and the total percentage of deaths due to stroke are rising over time. But if we focus, for example, on the first part of the graph, you'll see that the bars between women and men, which are the red bars and the blue bars, are about the same. They're not too different. But then towards the right of the graph, when we get to higher ages, older ages, we really start to see the separation between men and women. So, understanding why are there differences in stroke risk between men and women is an area of research that us and many other researchers are trying to tackle. And Kevin is going to share a little bit about that now.

### **[05:38 Sex-Based physiological differences]**

*Dr. Kevin Moncion:* All right. Hi, everyone. Today, I'm just going to discuss some risk factors between men and women. But before we go into that, it's important to highlight some of the unique anatomical and physiological differences that we see in males and females across the lifespan, but with or without stroke. And so when we're looking at this screen here, we see a male image. And typically, males have larger lungs and larger airways, and so they're able to take in more air when they take deep breaths. They tend to have larger hearts, and so they're able to pump blood to a greater capacity to working muscles and to other tissues in the body. They tend to have larger vessels, and so when they are pumping blood, that blood flow tends to go a little bit faster and a little bit smoother down to, again, working muscles and working tissues just because the vessels are a little bit larger in diameter. Now, when we're looking at bone density and muscle mass, men tend to be a little bit larger, and they have stronger bones, they have higher bone mineral density, and they also tend to have higher muscle mass. Well, in comparison to women, they tend to have smaller lungs and smaller airways in terms of their anatomy. They tend to have smaller hearts and smaller vessels. And so, when we're comparing them to men, they tend to pump blood a little bit less compared to men. And then similarly, they have a lower bone mineral density and lower muscle mass as well. And so, these are just some unique differences that we need to keep in mind when we're looking at some of the novel risk factors that we're seeing with women.

## **[07:26 Unique stroke risk factors in women]**

*Dr. Kevin Moncion:* And so, women tend to face some unique risk factors for stroke compared to men. And in this slide, I'm just going to discuss some of the more common risk factors that we tend to see. Women tend to be five years older when they first experience their stroke. They're more likely to live alone and be widowed at their first stroke onset. Because they experience stroke a little bit later in life, approximately five years later, and they tend to be living alone, women tend to have an increased pre-stroke disability as well because they're experiencing their stroke at a later time in their life. There is a stronger link between obesity and stroke risk amongst women. Women tend to have an increased risk for atrial fibrillation, which is just a rhythm disorder that occurs in the atrium of the heart. And so women tend to have a higher risk of ischemic strokes because of this rhythm concern in the heart, and so routine ECG is something that should be encouraged amongst women, especially as they age, because this is not a symptom that you can generally feel. Women also have an increased risk of stroke if they have diabetes or if they experience high blood pressure. And there are some evidence to suggest that there's a strong there's a bigger link between smoking and risk in women, even though men tend to smoke at a greater rate.

Now, it's important to also highlight some pregnancy-related risk factors for stroke that are definitely emerging as evidence is becoming more available. And so some common pregnancy-related risk factors for stroke include taking oral contraceptive medications, experiencing preeclampsia or gestational hypertension, which is just high blood pressure when you're pregnant, and then also experiencing gestational diabetes during pregnancy. And these are some risk factors that tend to occur in younger women, especially when they're pregnant.

## **[09:51 Role of estrogen in vascular health]**

*Dr. Kevin Moncion:* Now, there are a number of reasons why women face unique risk factors for stroke, and one of them is due to the role of estrogen. And estrogen has a very important role in our vascular health tissues amongst women. It actually helps protect, it has a protective effect in the vessels, and it helps vessels relax and contract. And so, vasoconstriction on this side of the screen is just an image showing a vessel contracting and getting smaller. And then on this side of the screen, we have something called vasodilation, and that's just the vessel being able to relax. And so early in life, estrogen has a protective effect on our vascular system in its ability to relax and contract in response to everyday stresses, like getting up from a chair, going for a walk, and doing some exercise. However, as we know, at midlife, our bodies, women's bodies tend to produce less and less estrogen as they progress through menopause. And as a result of that, they lose that protective effect of estrogen on the vascular system. And so there has been some accumulating evidence recently that this lack of production of estrogen increases one's risk for atherosclerosis. So, if I orient you to this figure here, here we have vessels in premenopause. And as you can see, this vessel here, there's no plaque buildup. As we progress through age, we accumulate some vascular risk factors, whether that's hypertension or diabetes, and that may promote some plaque buildup in the wall. And then as we transition throughout life, we lose our protective ability of creating estrogen. And so, there's an increased risk of this plaque buildup in the arterial wall, as we can see in these images here. And so, when we have this plaque build

up, that further inhibits our ability to vasoconstrict and vasodilate. And so, this is one of the possible mechanisms as to why women tend to experience stroke later on in life.

### **[12:07 Recognizing stroke symptoms and acting FAST]**

*Dr. Kevin Moncion:* And I'm just going to segue to a video to just highlight that despite the unique risks that we tend to see between men and women, they tend to experience similar risk factors. And I'm just going to show you this video here. It's about a minute, so bear with me. "Now he's been wanting to put garlic chunks in everything. Well, not everything. Dad, the side of your face is drooping. Mom? Probably nothing. Dad, are you okay? You're slurring. Why are you slurring? Raise your arms up in the air for me. Dad, are you okay? Gracie, call 911. Honey? Dad, I'm going to need an ambulance to send Fuller at you. Tim, look at me, Gracie. Tell them to hurry. Tim, look at me. Look at me, Tim. Mom, what are we doing? Dad, I don't know. I think he's having a stroke. I think my dad is having a stroke. Tim, what's going on, baby? He's cold. Are you cold, honey? Are you cold? Okay. Gracie? See, Gracie is going to come, sweetheart. We're just going to go. We're just going to go in the ambulance right now. We're going to go to the hospital, okay? Okay. I'm right here. I'm right here. Gracie, meet us there. I'm right here. I'm right here. Okay. Okay, here we go. You just stay right here. You just stay and breathe. Just breathe. Tim. Tim. Dad? Dad? How are you feeling? I'm fine. Well, you've had a stroke, but because you got here quickly, you're looking at a full recovery. All right."

So, as we can all agree, that video is quite intense, and it really highlights the importance of acting fast when we're seeing or experiencing somebody having a stroke. And so, just to highlight the acronym here, FAST. Face, is it drooping? That's one of the more common symptoms that we can visually observe. Can you raise both arms? And so if you're seeing somebody having this facial drooping, you can see if they're able to raise both arms. And if they're unable to, that's another strong hint that they are experiencing a stroke. Speech, is it slurred or jumbled? And if these three things are happening all at the same time, it's really important to act fast and to call 911. And that's what the time means. And the faster you act, the faster they can get treatment and fully recover.

And so, I want to highlight a few key differences that we do see amongst men and women from a symptom standpoint. And here, this is just a complicated graph to show different symptoms that are common amongst men and women. And on the left-hand side of the figure, we can see symptoms that are more frequent in men. And on the right-hand side, we can see symptoms that are more frequent in women. And so women tend to experience two unique symptoms that men tend to not. And that is having vertigo. And that's a sensation that the room is spinning. Women also tend to have more, tend to experience more difficulty speaking, which is known as dysarthria. The one common symptom that men tend to experience a little bit more than women is diplopia, which is a difficulty seeing, a double vision.

### **[16:10 Exercise and stroke prevention]**

*Dr. Kevin Moncion:* And so this is not all negative. There are some key lifestyle and exercise factors that can improve stroke outcomes. And one of them is the role of exercise as being a key primary and secondary prevention strategy for improving cardiovascular health and reducing

your risk of stroke. And so, so much amazing work over the years across the world has demonstrated that exercise is one of the key prevention strategies that is known to enhance our health. And for example, it's demonstrating to improve cardiovascular fitness. And so that's our ability to transport oxygen to our muscles. And the more efficient that we can do that, the healthier we are. And not only is it important for improving fitness levels, exercise is helpful for reducing common risk factors such as blood pressure. And so regular exercise three times a week, moderate intensity, can reduce systolic blood pressure, diastolic blood pressure measurements. These are common risk factors for stroke.

But it's also important for improving outcomes that are relevant for stroke survivors that are not so clinical. And so, for example, exercise can improve mobility outcomes. So their ability to walk further distances and their ability to walk at fast and usual pace. And so this is just a slide to highlight that, yeah, there are unique risks, but there are certainly some strong evidence to support that exercise and physical activity are key lifestyle modifications that can reduce our risk. And so I'm going to pass it on to Ada to continue the presentation.

### **[19:12 Sex-based risk factors across the lifespan]**

*Dr. Ada Tang:* Yeah, so Kevin talked a lot about changes that happen in our body system systems in the vascular system, what happens across premenopause and menopause. What happens with, what are differences in muscle biology in terms of lungs and heart size and things like that? These are what we think of as sex-based factors. Sex-based meaning they are things that are biological, and genetic, and physiological. And these differences, these sex-based differences, can exist across the lifespan of both men and women. So when we think about lifespan, we tend to think of it as that time between birth to death. And across the lifespan, women will have different risk factors that can affect their risk for stroke and heart disease across the lifespan. At younger ages, if some women might be taking oral contraceptive pills, when combined with other risk factors, that could increase their risk for stroke. During pregnancy, there can be a risk of stroke in people who develop diabetes during pregnancy. In menopause, or across that menopause transition, Kevin talked about the changes in decreasing levels of estrogen that can increase a female's risk for stroke. And then when we get towards, there may also be onset of illnesses and health conditions that can contribute to disability. And because we know that women tend to live longer than men, the accumulation of these health conditions can be more frequently seen in women than men.

So, when we think about lifespan, all of these things can happen in that time period between birth to death. We also like to think about a concept called healthspan, where it is that time before disability starts to have a really negative influence on a person's health and their life and the way they function. And so healthspan might be different from lifespan. Your lifespan takes you all the way to the time of death, but your healthspan might be longer or shorter depending on what's happening in a person's life. So, can we extend healthspan? Is this something that's modifiable? And we like to believe that it is. And through strategies like exercise and physical activity and social stimulation, there's a lot of things that we can do to change or to increase our healthspan as well. In the face of disability, studies have found that men and women might differ in terms of how they might address healthspan. And this gets beyond the genetic factors and the biological factors that Kevin talked about, but more into social factors, socio-cultural

factors, psychological factors, different things that we would term as gender-related factors. So, where we might have sex-based factors that are more on the biology side of things, there's also gender factors which are tied, we think of sex and gender to be linked, but they're not interchangeable. They're related, but they're certainly not interchangeable. And so gender is beyond the biology of our body systems. It's who we are and what defines us as people. It's our gender identity, how we might see ourselves as men or women or some fluid identity, maybe in between. And that's non-binary, but it's also things, other aspects of our lives.

### **[23:16 Gender disparities in rehabilitation and research]**

*Dr. Ada Tang:* There are gender-related factors that might play into the kinds of jobs that we hold, or how much education we have, or the roles that we might play in our lives as caregivers, as parents, as spouses. And it also can be institutionalized, meaning how society also sees us. So gender is a very complex concept, as is sex. And there's a lot of research now trying to unpack what are the sex differences, sex-based differences between men and women and their risk for stroke and their experience of stroke afterwards, and what are gender-based factors. And it's not that easy to disentangle. This is not easy because it is so complex and multifactorial. But we're trying slowly to chip away at some of these things.

When it comes to rehabilitation after a condition like stroke, there are some gender-related factors that the research has shown where women and men differ as well. And this is not just around the biology. It's not just that males have bigger muscles, larger lungs, and larger hearts, so they can exercise more. It's also some of those gender-related factors. There are some studies that show that women don't have access to rehabilitation the same way that men do, or they might choose not to participate in rehabilitation at the the same levels that men do. And there might be lots of different reasons for that, suggesting things like the roles that women tend to play in caregiving, caring for others, women might prioritize higher than participating in rehabilitation for themselves. I can't go to rehab. I can't be in hospital for another six weeks because I need to get home. My husband is home. My grandchildren are home. I need to get home to take care of them. And so we see this is where gender starts could have an influence on the opportunities that some people may take in participating in things like rehabilitation programs or exercise programs or other types of programs that can help with recovery after stroke.

In rehab, we might see there are differences in how women and men participate in stroke. We are also seeing some of that in research as well. This is challenging because if we don't have the representation of participants in research studies that really represent the population that we're studying, then we're not getting the full picture. If care decisions within health care are based on research that isn't necessarily representative of a population, then our care decisions might not be founded on the best evidence.

If we look at research in crash test dummies, I found this really interesting. Crash test dummies have been around since the '70s, and they've done lots and lots of studies to try to look at how vehicle safety during collisions. We're using crash test dummies to see what's the impact of collisions and safety belts and airbags and car body to protect the riders in the vehicle. Crash test dummies have been built on the dimensions and the weight and the size of an average male. It

was amazing to me to learn that the first female crash dummies was not used in this research until 2023. So, a lot later than I would have expected. And up until that point, when they were running crash test dummy research, they were using dummies, but just smaller-sized male dummies that were based on the male body proportions. So again, could there have been better decisions, different decisions made in designing vehicles and vehicle safety, if from the beginning, crash test dummies represented both the male and the female body type. In research, in heart disease research, it's been shown that the proportion of studies that focus on men are much higher than those that focus on women.

In stroke research, it's the same. In stroke rehabilitation research, it's the same. This is a study that was conducted by some of our colleagues, led in London, Ontario, and they took a look at all of the research that had been done in stroke rehabilitation for upper limb recovery. So this is the arm and body, or arm and hand shoulder. So these are only studies. Every point that you see here on this slide is one study that looked at upper extremity rehabilitation. Across the bottom is when those studies were published. So, they looked back as early as 2000, all the way up to 2020. If the proportion of female participants were at the 50% line, you would see all of those studies across that dashed line. But where you see the average of those studies is far below that, sitting at about 40%. So, remember at the beginning of this presentation, I talked about how globally, 56% of people with stroke, 56% of people with stroke are women. Studies are consistently not representing that proportion of women. And this is across where the studies are completed, where they were conducted. So, whether these studies were done in Europe, whether they were done in North America or Asia, Oceania, or in low, middle-income countries, so LMIC, across the board, we're not seeing the representation of women, and it doesn't change over time. So over the last 20 years, we haven't gotten better at this.

So some of the things that we want to do is try to understand why women aren't participating in stroke research the way that we hope that they would, because if we can have diverse research samples that really represent the population of study, then we can, hopefully, our research findings will better inform decisions that are made during health care. And so some research has found that women might decide to participate in a research study, make decisions about whether or not to participate in a research study differently than men. They might prefer to really think about whether that study is how it's going to impact them and their lives, what's the time commitment that they need to commit to to participate in the study. There's some research to show that men will agree to participate in the study because they can see, okay, well, they're experimenting on a new drug or a new therapy, and this is really going to help me recover from stroke. Whereas women might choose to participate in studies differently. They're more motivated by the notion that, if I take part in this study, I can help future people with stroke recover better. And that might be differences in motivation between men and women coming into research studies. So, a line of research that we're doing is really trying to understand why. What are the different motivations between men and women for participating in stroke rehab studies? And then also, what can we do about it so that we can try to level that balance and even increase the participation of women in these studies that truly represent the population. I like to think of is, how do we do, we're doing research so that we can be better researchers.

So today we talked a lot about this sex and gender, this continuum of sex-based factors and gender-based factors. And they are related concepts, but they're not the same thing, but they're

certainly associated with each other. We do recognize that we are more than just our biological sex at birth versus our gender. There's so much more to our identities than just sex and gender. And so future research that we are hoping that we will always be pushing for, but also other research is to consider the vast array of other things that define who we are, whether it's our ethnicity and race or religion or income or culture and the intersection of all of these. So, just in closing then, we covered a lot of ground in our time together, we shared that women are predisposed and affected differently by stroke. We know that women are underrepresented in stroke research, but they actually do benefit from stroke treatments as much as men. If we can get them in the door, they will accrue as much benefit from those rehabilitation strategies as men. And exercise and lifestyle factors can reduce the risk and improve recovery after stroke. So with that, Kevin and I would like to really thank everyone for joining us today, and of course, to the McMaster Optimal Aging Portal for inviting us to be here today. Our contact information is here. This is a picture of us on campus. This was many years ago, but it always just seems like yesterday. And we would love to hear from you.

### **[33:28 Modifiable risk factors and prevention]**

*Dr. Anthony Levinson:* Thank you so much, Ada and Kevin. We have a lot of great questions and more coming in. So, let's start off by talking about the broad category of stroke risk factors and prevention. What are some of the best ways for women to prevent strokes as they age?

*Dr. Kevin Moncion:* Yeah, that's an excellent question. There are several things that we talked about today in terms of risk factors and how women experience unique risks. But it's really important to highlight that many of these risk factors are modifiable. And so even though we might have them currently, we can reduce these risk factors.

And so one of the areas that Dr. Tang and I research on is around the role of exercise. And there's plenty of really strong evidence that's been around for a long time, and it's only getting stronger and stronger as we're doing clinical trials and looking at the role of aerobic exercise for improving our fitness levels. So, like I mentioned in the presentation today, it improves our cardiorespiratory fitness. And so that's a strong prognostic factor for a stroke recurrence, mortality. And so the fitter we are, the less risk of having a recurrent stroke is. Now, that's from a fitness standpoint.

There are quite a bit of benefits as well from physical activity, regular physical activity. So, we tend to recommend a 24-Hour Movement Guideline. So, around 150 minutes of moderate to vigorous physical activity is also associated with improvements in risk factors, and whether that's reductions in blood pressure, or improvements in cholesterol levels, or even improvements in blood sugar control, there's plenty of evidence supporting that as well as a lifestyle factor. So, it doesn't have to be structured, going to the gym, exercising really intently. There's benefits with structured exercise, but also just everyday physical activity, whether that's gardening or going outside for a brisk walk, going for a hike, things like that. That all is linked with better heart health and stroke reduction risk. And so I don't know if you have anything to add to that, Ada.

*Dr. Ada Tang:* The other thing that I will say is when we talk about exercise, it doesn't have to mean getting up and running a marathon or 10K or 5K. It doesn't need to be that. Any physical activity is going to be helpful. The more intense activity will tend to be more helpful, but you don't have to start at that right away. And we know from exercise guidelines that you want to make sure that you're doing exercise safely, and anybody can start at a lower intensity level exercise and just start moving. And over time, as you get fitter and you get stronger and you do it at a progressive, gradual pace, progressing, that risk goes down. So it used to be that we thought, if you had heart disease and you were obese and you had diabetes and your kidney disease, all of these things added up to high risk associated with exercise. But we know now that your risk is not static. Your risk changes based on how active you are. I like to think of this as, this is the doorway in. If you just start to move, you're lowering your risks associated with exercise. And then the benefits will outweigh those risks the more you continue to exercise. And again, as Kevin said, exercise doesn't have to mean hopping on a treadmill and running for an hour. It could mean going out for a walk. It could mean gardening. Gardening can be a lot of really hard work, right? It could be keeping up with your grandchildren. It could be lots of different things. Every little bit of movement counts.

### **[38:04 Post-stroke fitness and community programs]**

*Dr. Anthony Levinson:* Well, we've got some lots of follow-up questions related to this as well. Do you have any recommendations for post-stroke fitness, particularly? Where would one look for this type of programming?

*Dr. Kevin Moncion:* Yeah, great question. I would say there's programming available through community centers. There are, depending on, of course, where you're living in Ontario, these programs might differ a little bit, but there are programs that are research evidence-based. One example is Fit for Function. That's a program that actually Dr. Tang developed. That's an entry program for stroke survivors in the community. It's a lower intensity exercise program that is just to get the ball rolling with physical activity and exercise. And so I feel like that's an excellent starting point for stroke survivors that are living in the community to get introduced to maybe some more novel movements that they might not be aware of or they might need assistance with in terms of technique. And then, of course, once there's that, there's other programs that they can transition to that are maybe a little bit more difficult in the community. And so, again, it's quite region specific, I would say, but there are certainly programs out there that exist. And of course, there's tons of resources through the Heart and Stroke Foundation website that have specific guidance on physical activity guidelines and exercise guidelines that are specifically geared for stroke survivors, and there's insights on what to do if you need help and videos and things like that. So, tons of excellent resources there, if there isn't specific programs that are available within your community.

*Dr. Ada Tang:* The great news is that the more and more research that's coming out, there's more and more community programs, community centers, senior centers that are looking to expand their program offerings to their communities. Fit for Function is one. We're proud that it started in Hamilton and has expanded to a couple of other areas within the Southern Ontario region.

But there are also other programs that are across Canada as well. TIME program and FAME, these are other research-supported exercise programs for people with stroke, and they've been developed by our colleagues in Toronto and in Vancouver, and they've been picked up by Parks and Rec services across the country. Those have been really great to see the uptake of that. Jessica has just put something in the chat there about Fit for Function. But these programs are part of the Canadian best practice guidelines around community exercise programs. And we think that the important thing is that, rehab is not in hospital, and rehab doesn't just happen when you're in a hospital, but rehab after stroke continues for your lifetime. And the more we can get programs and services out there in the community that's outside the hospital walls, the better the health of our whole communities will be.

*Dr. Anthony Levinson:* One of the questions that came in was whether there were any guidelines for exercise, if there might also be a heart condition. And it does sound like some of the programs you're mentioning, though, are, ease people into it, and so they might also be safe for people with heart conditions as well. Is that fair to say?

*Dr. Ada Tang:* Absolutely. Fit for Function, for sure, and the other programs will carefully screen anybody who's interested in these programs to make sure that they are safe and will stay safe during exercise, for sure. Some of the studies, all of the studies that we do in stroke and exercise, we carefully screen all participants as well, and we'll work with you and your family doctor to make sure that you have been cleared to exercise. We monitor everything very carefully, and we progress things gradually, and try to customize an exercise program based on each person's abilities.

### **[43:08 Delayed rehabilitation and recovery potential]**

*Dr. Anthony Levinson:* I think this is an interesting question that came in talking in part about rehabilitation resources and the timing of it. You mentioned in the example, sometimes you may have women who have a lot of other duties at home who might potentially defer or forego acute rehabilitation because of other commitments. So, this question is, some of the resources, rehabilitation resources may not be available, especially limited in urban centers, even less available in rural areas. And the question is, what is the impact of reduced or delayed stroke rehab? Many people are left to do the work on their own without consistent follow-up.

*Dr. Kevin Moncion:* Yeah, and that's a reality that we face in our world for sure. I would say it's never too late to start rehab. And so benefits are certainly possible months, weeks after acute stroke onset, and so it's never too late to start. And obviously, it's encouraged to start earlier than later, of course, just in terms of full recovery in those types of aspects. But certainly, there is evidence to support that. It's never too late to start. And so benefits are definitely possible, even if you start months after stroke onset. And whether those improvements are from a mobility aspect or a functional aspect from upper extremity function, but there's certainly tons of evidence for cardiovascular health improvements any time after after stroke onset, years even.

*Dr. Ada Tang:* Definitely. We tend to think of that early first days and weeks after stroke as being this critical time point for recovery. And it is. The brain is in that time, the most plastic, we use that term, meaning it's most amenable to change with rehab. And so that's why we have,

we try to get people in earlier so they can get that intensive rehab as quickly as possible. But even outside that window, as Kevin says, people will continue to recover for years after stroke. And that's a matter of reducing some of those secondary complications from stroke or secondary deterioration from maybe not being as mobile, then your muscles become stiffer, your muscles get weaker, your heart is weaker, and then it sets up this cycle, this vicious cycle of declining function and declining fitness. And that cycle can be broken anytime. And that cycle can be broken. It doesn't actually matter.

One of the studies that we are launching very soon. I'll put in a plug for this now for anybody who might know somebody who's experienced stroke in the Hamilton community or in Kelowna, actually. We're doing a new study looking at exercise, particularly muscle strengthening exercise after stroke. We don't have an upper limit for how long after stroke they're eligible for this study. We'll take people that are 5 years, 10 years, even more after stroke. So we'll see if an intensive muscle strengthening program can benefit recovery after stroke.

*Dr. Anthony Levinson:* So, this is a comment, because I think both you and Kevin spoke about there's quite a bit of data on aerobic exercise and even high-intensity forms of exercise post-stroke. This is looking at the other aspect of exercise and training and seeing if strength training will also improve outcomes. Is that right?

*Dr. Ada Tang:* That's right.

*Dr. Anthony Levinson:* That's interesting.

*Dr. Ada Tang:* That's right. Yeah. And Kevin's study where he looked at high-intensity interval training after stroke. This was just published last summer. We enrolled people up to thirty years post-stroke?

*Dr. Kevin Moncion:* Five.

*Dr. Ada Tang:* Five years post-stroke. So up to five years post-stroke. And we saw really important improvements in fitness levels then.

*Dr. Anthony Levinson:* Sorry. Go ahead, Kevin.

*Dr. Kevin Moncion:* I was just going to quickly hop in there and say, we just got a paper published today. It just came out today looking at some of those neuroplasticity markers that Ada was just talking about. And because we looked at up to five years post-stroke, we did see improvement of those neuroplasticity markers really late after stroke onset. And so to our point about when we should start earlier, certainly better, but it's never too late from a cardiovascular health standpoint. But even a recent paper coming out today, we can certainly share with you once it's actually published on, it's demonstrating that there are improvements in some of those novel neuroplasticity markers as well.

## **[47:46 Understanding TIAs and silent strokes]**

*Dr. Anthony Levinson:* Interesting. There's a couple of questions around transient ischemic attacks and silent strokes. So, one of the questions is, what is a transient ischemic attack, and can it be a precursor or a warning for a stroke? And also, can one have a silent stroke similar to a silent heart attack?

*Dr. Kevin Moncion:* Yeah. So, a transient ischemic attack is different than a stroke. It's similar, but it's different in a way. And the reason why it's different is a transient ischemic attack is a very fast, sudden disruption in blood flow to the brain that results in a mini-stroke, let's just say. And it's a very quick acting, I guess, event that occurs in the brain. And it really presents itself like a stroke. But the key difference is that a transient ischemic attack goes away. Whereas a stroke, the blockage is there and the symptoms remain until the blockage is removed. A transient ischemic attack is just a very sudden change in blood oxygen levels in the brain. It could be as a result of a hole in a heart. It could be a very, very small, like an extremely small clot. But it's very transient, and it goes away very fast. Within 24 hours, generally, those symptoms disappear. And so that's what a transient ischemic attack is.

In terms of whether it increases one's risk for a stroke, I would say it certainly is a potential risk factor for a future stroke. And so, if you have experienced a transient ischemic attack, the symptoms will look similar, and so definitely, you need to act fast and go to the hospital. And so, you might be diagnosed with a TIA or a stroke. But certainly, there is possibilities that this can lead to a future stroke down the road. And so, yeah, definitely important to monitor for sure.

*Dr. Anthony Levinson:* And it is interesting to the question of silent strokes. Yes, so many people may not be fully aware that they have even had, it's almost like a more silent TIA because you basically won't necessarily have had symptoms, but you may have had very, very small strokes. And one of the other questions that had come in was, how can strokes be diagnosed after the fact? And in addition to taking a careful history and doing a detailed neurological exam, brain imaging, usually with a MRI scan, more sensitive, but also with a CT scan, can show evidence of previous silent strokes or previous strokes after the fact, those are the most common ways that people would diagnose them after the fact.

*Dr. Kevin Moncion:* Yeah, absolutely.

## **[51:03 Participating in stroke research]**

*Dr. Anthony Levinson:* Any final words just on the time? I'll ask you, Ada, to address one other final question that came in that relates more to the hesitation of women to come forward to participate in research. And how would one go about participating in research focused on women's experience, and any suggestions for people for how to get involved?

*Dr. Ada Tang:* No, that's a that's a really great question. One of my colleagues in Toronto actually just wrapped up a study trying to understand what are some of the reasons why different people, both men and women, might participate in a trial. We're just working on that paper now, so we'll hope to get that out soon.

But, some of the stuff that we're doing now, some of the research that we're doing now, is to look at studies that are ongoing, maybe some clinical trials that are ongoing or stroke research studies that are ongoing, and as we're recruiting into those studies, participants into those studies, we'll also ask them whether you decided to participate or not, what are some of the reasons why? Was it how the researcher had approached you, or is it time commitment that you're not able to give that, or is it maybe it's a drug trial and you're not certain about the safety of it, and try to understand some of that.

If somebody is interested in participating in this research or in any research, I would say there are some patient advisory councils that are being struck. Kevin and I are in Montreal right now, actually, at a meeting, and we're going to be talking about a patient advisory council for stroke recovery trials platform that we're both a part of. I think they're getting ready to launch this soon. This will be something that we can certainly share with the Optimal Aging Portal to invite people to participate in this patient, I don't remember the name of it off the top of my head, but whether it's to be part of the database and to be linked with researchers who are recruiting for studies in the future, or to work with researchers to inform what kinds of questions will be important questions that we should be working on, or maybe giving input on the design of studies, or giving feedback on your consent form makes no sense at all, you need to really make sure this language is a lot better so that people can understand. So there's lots of different ways that people can get involved in research, not just as a participant, but actually informing us about what we do.

*Dr. Anthony Levinson:* That's great. MIRA or the McMaster Institute for Research on Aging also has a platform called Voice, which allows people to find out about research studies in McMaster. I will actually ask one other question, but also highlight again that the number of questions coming in, some of them about other potential risk factors or treatments. I feel like this topic is so important that we'll likely have another session on that.

### **[54:44 Emergency planning for those living alone]**

*Dr. Anthony Levinson:* But one of the questions, a few of them that came in was about living alone and emergency planning. And do you have any suggestions for women who live alone? Any alert systems or things that might help if somebody's speech were affected? How could you call for help? So any tips around some of those scenarios for the listeners?

*Dr. Ada Tang:* Yeah, I mean, I think those are really valid concerns, and certainly, safety and time to get to medical care is certainly paramount. And I would say for not just women, but anybody who is living alone that might be just want that extra layer of security, that to dial 911. and even if you cannot say anything into the phone, 911 will be able to trace the call and hopefully be able to locate where you are. But, those alert necklaces, emergency alert buttons would be a great idea to consider, right? So that, again, if you fall in and you can't get to your phone, you still have a way of getting help.

*Dr. Anthony Levinson:* And I think this is also an area of active research with smart homes and technologies, trying to balance privacy, but having things like motion sensors or video that if one

is detected falling rapidly, perhaps one's had a stroke, that the technology might be able to alert someone. Sorry. Go ahead, Kevin.

*Dr. Kevin Moncion:* I was just going to just provide maybe just one piece of advice, something that I often talk to some of our participants and patients about is having a telephone that is easily accessible and low to the floor. I know that sounds goofy, but somewhere that is accessible for if you do fall and you need to crawl or say, maneuver to a telephone. Having a phone on a small bedside table that's lower to the ground and not on a kitchen countertop, for example, might be just an easy solution or a potential solution that might be a little bit easier to get access to the phone if you are alone. It's something that's easily, it's an easy solution that you could potentially have at home. So, I just wanted to highlight that.

*Dr. Anthony Levinson:* That's fantastic. I just want to finish up as I usually do, just for any viewers who are not familiar with the McMaster Optimal Aging Portal. We have more great information around stroke. It is a continually updated resource with evidence-based health and social information. You can subscribe to our weekly email alerts with updated articles being added. You can access our blog posts, our e-learning, weekly Hitting the Headlines. Recorded videos of our webinars like today's will be added both to the Alumni Association YouTube site, but also reposted on the Portal as video posts, along with lots of other content. We will also publish multimedia e-learning lessons on a wide range of topics. This is an opportunity to take a deeper dive into some topics. And if you enjoy getting nuggets of information in your inbox, many of our curricula now have micro- learning emails, generally weekly emails of anywhere from 3 to 12 in a series on a focused topic. The YouTube channel now has over 40 videos and thousands of subscribers and views. This recording will be available in the next couple of weeks. It'll be published tonight, most likely on the Alumni channel. So, Ada, Kevin, I want to thank you all, and thank all the viewers for your questions. And as I say, promise we'll do another stroke prevention webinar, because of it being such a hot topic. Thank you all for joining us tonight.

*Dr. Kevin Moncion:* Thank you so much.

*Dr. Ada Tang:* Thank you.

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