

## Raising the Bar Sydney 2018

### Maria Fiatarone Singh – Do you even lift?

**Welcome to the podcast series of Raising the Bar Sydney. Raising the Bar in 2018 saw 20 University of Sydney academics take their research out of the lecture theatre and into bars across Sydney, all on one night. In this podcast, you'll hear Maria Fiatarone Singh's talk, Do you even lift? Enjoy the talk.**

[ Applause ]

Thank you. Thank you everybody for coming tonight. I'm just going to take you to the other end of the spectrum for those of you who were here for the earlier talk on neonatology. I'm a geriatrician as you've heard, and have spent most of my career looking at the benefits of exercise for older adults. So 30 years ago when I was fresh out of my geriatric fellowship training at UCLA, I went back to Harvard and was asked to give a talk to my colleagues.

It was going to be a very big talk and I wanted to tell them something about what I thought was important in geriatric medicine. But I was a little bit afraid because people at Harvard are a bit elitist. I didn't think they would take to my message very well because exercise really had very little to do with geriatric medicine at that time. So as you do, I asked my firstborn child at the time, Christina who was four years old, why should old people exercise? So she was doing a painting at the time and thought about it for a minute and then looked up casually from her painting and said very matter-of-factly, "Because if they don't, they will get as big as a house. And if they do, they will be strong and happy and able to take care of themselves."

So in that one sentence Christina foreshadowed pretty much the next 30 years of my career as well as most of the trajectory of my colleagues in geriatric medicine. Thinking about how exercise might be able to change the way that people live and the quality of life, and even perhaps the length of their lives.

So until that time when I first went to Harvard, no one had really thought about muscle as something to do with health and ageing. Until another doctor that I was very lucky to work with at Tusk University, Dr. Irwin Rosenberg who was a gastroenterologist and a nutritionist. He went around the hospital wards and he used to say that he would constantly lift up the bedsheets and he'd see these skinny little legs poking out. And he realised that somehow this might be related to what was wrong with these patients, to their infections, to their frailty, to their falls, to their malnutrition.

But nobody was talking about it. Maybe nobody else was lifting up the bedsheets, but nobody was actually talking about this wasting of skeletal muscle that he saw. And at the time there was a Kevin Costner around about building a baseball field and if you build it, they will come. And so Irv though, "Well, if I name it, maybe they will start to treat it." And so he thought, very similar to what had happened to the loss of bone with ageing which never had a name for many years, and then somebody thought to name it osteopenia and osteoporosis. He thought, "Well, that would be a good name."

And so he literally took that name, poverty of flesh, and called this new condition that he had seen and thought about sarcopenia. And that was really the beginning of this new condition which up until that time nobody had really put into their thoughts about how this could be part of medical practice, how you could do something about it.

Since that time, there have been literally thousands of articles written about the aetiology, the way to diagnose and the way to treat sarcopenia. And it has become really almost a centrepiece of geriatric medicine and frailty research for many individuals. And 27 years later, after Irv Rosenberg actually named this syndrome, it now has its own official ICD 10 diagnostic code. For those of you who don't know what that means, that means that hospitals and doctors can diagnose it, if they will, and they can actually get reimbursed for treating it, which is the very first time that that has ever happened, in 2016.

So Christina's observations as a four-year-old that people who don't exercise will get big as a house really has a lot to do with this thing called body composition changes over time. Not only losing muscle as Irv noted, but also gaining fat. And gaining fat in particularly bad areas of the body like the trunk and the visceral area. Because that kind of fat is actually linked to lots of disease. And it's really this shift from anabolism where you're growing and you have lots of lean tissue, muscle and bone, to catabolism where you have lots of fat in the wrong places and not so much lean tissue.

So that catabolic/anabolic shift is what more and more people are recognising is at the heart of many things that are really underlying chronic disease and ageing. Things like cardiovascular disease, diabetes, osteoporosis, arthritis and even now we're recognising it as contributing to things like depression and dementia. So Christina was right: if you don't exercise, you will get big as a house. But it's not any kind of exercise that will actually make you retain your lean tissue. There's a particular kind of exercise which we were interested in called progressive resistance training. Which means that as you use your muscles, you gradually use them in ways where you're overcoming more and more of a force.

So as you leave the womb and go out into real life, because you're growing and you're using your bodyweight against the force of gravity, your muscles do get bigger as you age, to a certain point. So when you get to the age of about 30, your body stops growing and then your muscles really don't – even though they're opposed to the force of gravity, they don't really have a reason to continue to grow. And so as the brain changes that time, sending signals to the spinal cord and the muscles, there begins to be an atrophy. Even though you're still exposed to gravity, you're still walking around the earth.

So that by the time you're about 80 years of age, if you're a woman, you actually will have lost about 50% of your peak strength, about 40% of your muscle mass and about 75% of your ability to produce muscle power, which means the ability to contract at high forces with high velocity. So there is a way to prevent this from happening, and this is something that was discovered many years ago, about 500 BC, by somebody named Milo of Kroton, a Greek Olympic wrestler. Who it was said had legendary strength.

And the way that he trained himself was that every day he would put a calf on his shoulders and he would climb up a hill. And as the calf got bigger and bigger, he would naturally have to get stronger and stronger. So by the time it was full-grown bull and weighed a tonne, he was still able to carry this bull up the hill on his shoulders. So legendary feat of this resistance-trained man. I think Milo is named after him. I'm not sure. So for most of us who don't carry a bull on our shoulders up a hill every day, unfortunately we tend to sort of plateau in terms of our muscle mass and our muscle strength by about age 30. And then it gradually goes a bit downhill from there.

But we do have this antidote in our back pocket, this thing called progressive resistance training. So when I went to Boston 30 years ago, I went to the place where it seemed that no one had ever thought about making people life heavy weights. And that was a nursing home. It was nursing home filled with primarily Holocaust survivors in their '80s and '90s and even some centenarians who were really there to be cared for but weren't really doing anything very active with most of their day.

And so I wanted to do this weightlifting study. I wanted to follow Milo of Kroton's advice. And so I went there and I held a group meeting and I called them down to the auditorium. And I said, "Well, we're going to start this exercise study. Would any of you like to join it?" It was sort of deathly silent in the room. And I said, "Well, you know, maybe it would make you live longer." And these 90-year-old Holocaust survivors looked at one another and looked at me with scorn and said, you know, "What is she talking about? Why would I want to live longer?"

And so I said, "What, if anything, would make you want to join our exercise study? What can you think of that would make you want to exercise?" And so this little old 91-year-old man raised his hand kind of meekly and he said, "What I would like is I would like to be able to get up from my chair, walk to the bathroom, come back, sit down again without calling a nurse." I said, "I can give you that. I can do that."

And so we did a study called the Fix-It Study which was one of eight different studies looking at ways to treat frailty and injuries in older adults. And we did it to see first of all, could older muscle actually respond the way that young, healthy muscle does if you exposed it to heavy loads? So we did a very traditional kind of weightlifting where you measure somebody's strength. You give them a weight to lift that is about 80% of what they can lift when they're lifting as hard as they can. You don't have them lift it very often, just about 24 times for each muscle group. Do that three days a week.

And we did that for ten weeks. And what we saw was that not only could they do it and was it safe, but in fact we were able to double their muscle strength, 100% increase in their muscle strength. They walked better, they walked around the nursing home about 30% more of the time than the control group. They were able to climb stairs faster and we actually biopsied their muscles. We biopsied their quadriceps muscle. And when we looked at the muscle under the microscope, what we saw was that there was some remarkable regenerative changes going on, something that we don't see usually in adult life. In fact, I was told in medical school that you have all the muscle cells you're ever going to have when you're a child; you don't actually grow new muscle cells as an adult. But in these muscle biopsy specimens, what we saw was what we call embryonic myosin which is a protein in the muscle which forms the contractile parts of the muscle that you usually only see in embryos or in neonatal life. But we were seeing it in these 90-100-year-old muscle biopsy specimens.

And we saw a growth hormone that again is usually only seen in response to severe injury or denervation called IGF-1. 500% increase in this growth hormone in these skeletal muscles. And even more astonishingly, what we saw were these baby muscle cells, myoblasts. I was having one of my babies at the time, my third baby. So he was my favourite at the time, but this was pretty close. This little baby muscle cell was one of my next favourite babies. Two of my other babies are sitting in the front row here so I don't want to malign anybody.

But this little myoblast was there. You could tell it was a myoblast because of the way it looked with its tiny little myofibers and really big nucleus. And then there were also myotubes, two little myoblasts fusing together. And ultimately those myotubes would attach themselves to a mature muscle fibre, make it grow larger – that's called hypertrophy. Or even some of them would actually become mature muscle cells themselves called hyperplasia: new muscle cells forming in 95-year-old thighs. So it was really pretty remarkable that that could happen.

So Christina was right: if you exercise, not only will you not get as big as a house, but if you exercise you can get stronger. You will be stronger. But that wasn't where she left it. What she also said was, "If you exercise, you'll be strong but you'll also be happy." So that was a bit strange, but again, eerily enough, little four-year-old Christina actually predicted something that was then going to happen over the next two decades or so, was a huge shift from the way that we think about depression and treating depression not only with pharmacology but also treating it with lifestyle changes.

Things like mindfulness, even dietary things. And yes, exercise. And so we did a study in 1997 which was the very first study looking at weightlifting exercise for the treatment of clinical depression in older adults. Now there had been studies in young adults showing that weightlifting was about as good as aerobic exercise, and nobody really knew it because everybody thought to be happy you had to run because running produced endorphins and endorphins were why you got happy.

It turns out that's not really the case. That's not probably the reason that it works, but it did look like many kinds of exercise in fact were good for younger adults, and we thought, "Well, if you're old and you're also maybe having this sarcopenic obesity problem and you're a bit frail and you don't walk around very well, maybe the kind of exercise that you need for your depression isn't running. Maybe you can't run because you can't. But maybe weightlifting would be a good way to think about changing the body and the mind together."

So again, we found that interestingly enough, weightlifting exercise had very powerful, potent effects on depression, not only in older adults but also in younger adults. And that in fact it turned out that it mattered what kind of exercise you did. And the people who did the heaviest weightlifting got the biggest effect compared to ones who just did light weights, it didn't really work. It was like a placebo. So what that meant is we were looking at something that was like a drug. It wasn't just herding people into a room and patting them on the back and saying, "I think you should be a little more active. You'll feel better."

Because in fact that's what we did to the control group. We put them in a room. We talked to them, we gave them light exercises to do and that actually didn't work for their depression. But for the ones who lifted weights and particularly the ones who lifted heavy weights, it actually had a pharmacological effect. In fact, better than a pharmacologic effect. And now people have done quite a few systematic reviews of exercise and comparing them to other kinds of therapy. And in fact if you look at all of the drug studies including the ones that the drug companies don't publish, which is a huge number of them it turns out – and in fact, all of the negative drug studies don't get published.

But if you look at all those together and compare them to exercise, what you end up seeing is that exercise has about three times the effect on depression that the best pharmacologic agents we have today do. And in addition, it's actually far safer in an older adult, because antidepressants cause falls, they cause hip fractures, they can cause mental clouding and confusion. And they can cause nausea. They can cause sleeplessness. So lots of things that you're trying to get rid of in older adults are actually made worse by the very drugs that you're prescribing for their depression.

So exercise for depression is like a drug. It has dose-response effects. It has relapse if you stop it. And if you maintain it, it actually prevents recurrence of depressive episodes. So Christina again was very much on the money that if you exercise, you will be happy.

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And the final bit of her advice was that if you exercise – or old people should exercise because then they'll be able to take care of themselves. Again, it was sort of a way that over the next 30 years most geriatricians would now think of what we do for a living is to try and help people live a functionally better life. We're not necessarily trying to make them live longer, like my 90-year-old Holocaust survivors reminded me. They don't really necessarily want to live longer, but they do want to live better. You do want to live better. And being able to take care of yourself is something that has something to do with sarcopenia, but it also has something to do with this condition called frailty which is a bit hard to define.

We all know what it looks like, right, when somebody's frail. But to put it into words is a bit difficult. For most people, if they're trying to put it together as a syndrome would say it's some kind of a combination of loss of weight which includes loss of muscle mass, slowness, so walking more slowly in particular, fatigue of some sort, being sedentary or relatively inactive, and being less able to take care of yourself without help. So that syndrome of frailty is something that we are again now more and more recognising as part of medical care.

And the WHO has estimated that by 2050, there will be 2 billion people in the world who are over the age of 65. A relatively large portion of them are going to be frail. In fact, about 25% of those over the age of 85 are going to be frail. And if we don't stop the way that we're currently ageing in terms of being sedentary and overweight and not eating well and being depressed and being stressed, then probably many of those people between 65 and 85 also may end up being frail.

So again, it turns out that we don't have any drugs to treat frailty. So unlike depression where we do have drugs but they're not so good, for frailty we have no drugs. We have no drugs at all that can treat slowness of gait, loss of weight and muscle. But we do have this drug called exercise, and particularly the kind of exercise that we're talking about, this robust weightlifting exercise is really a very good antidote for frailty. So as an example of that, we've tried to implement this in many different chronic diseases.

One of the ones that we decided to look at was hip fracture a few years ago at RPA hospital. And we actually went around the wards and found people who had just broken their hip. And we divided them randomly into two different groups. One of them just got usual care which is quite good in Australia. Usual care means you get your hip replaced by your ortho/pod. You get geriatric consult, you get six or 12 weeks of physio. You're ortho/pod sees you at six weeks post-op and there is ancillary support for other things that go on. So that's standard hip fracture care in Australia.

So what we did was take the experimental group and in addition to all that usual care, we said, "Well, we're going to give you something to treat your frailty and something to treat your sarcopenia. So we're going to screen you for all the things we can think of that are reversible contributors to sarcopenia." Things like depression, like cognitive impairment, like malnutrition, like polypharmacy, like poor strength, like sarcopenia, like low balance and mobility impairments. Like low self-esteem, isolation.

So all of those things, all of them in many, many studies contribute to frailty. But all of them have a way to be treated, and the core of our programme was actually high-intensity weightlifting exercise and balance training for an entire year. So not just for six weeks as the fracture's been healing, but actually for an entire year after their hip fracture. They came into Bauming Hospital twice a week. In addition, if they were malnourished, we gave them food. If they were lonely, we cheered them up. If they had low self-esteem, we gave them more confidence. So anything we could do to actually make them better. But none of it was really drug-based. All of it was really based on these ancillary things that we thought were really important to their quality of life.

So what happened? Well, compared to the control group, we reduced their nursing home admission in the year post-hip fracture by 85%. And we reduced by death by 84% compared to all of that control activity. And we did it in the setting of an outpatient hospital at Bauming using a typical multidisciplinary geriatric team. We just made that team do a little something different. We made them do what Christina said was important, was to do the kind of exercise that makes you stronger.

Because that isn't what we do in medicine, usually. It isn't what we actually treat normally. So from that study we also have looked at many other conditions, at osteoporosis, at renal

failure, at heart failure, at depression, at cognitive impairment and dementia. And in all of those cases there seems to be this very central role for this radical body composition shift that happens with ageing where you get too much fat and too little muscle.

And that sounds like, "Well, why would that affect your brain?" But it turns out, because that fat is toxic – it's in a toxic part of your body. It's in the viscera. It sends out these evil hormones, these cytokines and adipokines that go to your liver, make you produce more inflammatory cytokines. And all of those inflammatory mediators go to other parts of your body and destroy them. They destroy your neurons in your brain, they destroy your muscle cells. They diminish your heart contracting ability. And they even make you depressed. They make your hippocampus shrink and they can make you depressed.

So there is a solution to that anabolic/catabolic shift, but it requires a very different paradigm shift to the way that we ordinarily think about ageing, and what we ordinarily think is actually reversible about the ageing process. So I think that's really the message of what we have done over the last 30 years in geriatric medicine. Not just myself, but many, many people in geriatric medicine have really come to understand that all of these things that we've been ignoring for so long because we don't have drugs for them are really at the core of quality of life and happiness for older people.

So the only difference between using exercise for example for depression and Prozac is that the government will pay for the second one and the pharmaceutical companies will benefit from it. And the first one will make you look better and make you stronger. But we do have two different ways to treat these things. And I think we need to think a little bit more about moving away from pharmacology when we're getting to the last decades of life and thinking about the other things that we can do that are probably more potent than what we can actually do with medicine at that point in life.

So what I want to leave you with at the end are some thoughts from a relatively well-known Australian centenarian and master athlete. Some of you may know the name Ruth Frith who died in 2014 at the age of 104. She took up athletics at the age of 73. Before that, she was actually kind of a coach and an administrator for many different sort of sporting teams. But she was never actually an athlete herself. Although she probably had good genes and probably good epigenetics as well, because her daughter actually became an Olympic athlete.

But nonetheless, at the age of 73 she started participating in athletics and track and field events, things like the triple jump, the hammer throw, the discus, the javelin, the shotput, the weight throw. At the age of 102 she became the world's oldest competing athlete, competing in all of the Master's games. She holds the world records – which I don't want to forget any of these. The women's 85 triple jump, the women's 100-year-old shotput discus, hammer throw, weight throw and javelin throw, and is the oldest competitor to have ever competed in what's called the throwing pentathlon which is all of those throws put together.

She's famous in fact for a quote not about exercise but about diet, in which somebody asked her about what is her secret to living so long at the age of 103. She said, "Don't eat vegetables, because I never eat vegetables. I know people who like diets that will scream at me for saying this, but my advice is don't eat vegetables. I never have."

[ Laughter ]

And probably even more interesting to me is that when she was interviewed coming off the track at 102 at one of the Master's games, a reporter from ABC went up to her and said, you know, "Tell us what you do? What's your training regimen?" She said, "Well, three days a

week I do my track preparation with my throwing, my javelin, shotput. The other three days I lift weights. So I bench press and do those other things."

And he says, "That's pretty interesting." And he said, "So you know, do you talk much to women your own age? Do you have much in common with women your own age? And what do you talk about when you sit around with your girlfriends?" And she kind of looked at him quizzically on the video that you can see on YouTube. And she said, "Not much to talk about. You know, they don't even lift."

[ Laughter ]

So I leave you with these final words from a true master and a true mentor. And I wish you strength and health and hope that you continue to raise the bar, any bar in whatever location you find that bar throughout life so that no one ever has to ask you, "Do you even lift?"

[ Applause ]

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