

GAIL DECHMAN DISCUSSES THE INDIRECT 1 REP MAX TEST

Dr Pat Camp:

On today's episode, I'm so pleased to welcome my friend and colleague Gail Dechman to this show. Gail is a faculty member in the School of Physiotherapy at Dalhousie University, and she has been involved in pulmonary rehab and physiotherapy practice for many years. Her research area really focuses on using exercise to improve function in people with chronic diseases across a really interesting variety of chronic diseases, actually. She's done work with people with Chronic Obstructive Pulmonary Disease, cancer and obesity, and her research is really looking at developing functional outcome measures to objectively assess changes in activities of daily living for community dwelling people with disabilities, and Gail you and I have worked together for many years, and I just am really happy that you've come on the podcast today. So welcome!

Dr Gail Dechman:

Thanks very much. I'm really pleased to be here.

Dr Pat Camp:

So, like I said, we've worked on many different projects of the years, and we've had so many great discussions about all different aspects of pulmonary rehab. And today I really wanted to chat with you about a topic that's so important to clinicians working in this area, and that's really related to muscle strength testing in pulmonary rehab. And just as a bit of background Gail and I, we led a project for the Canadian Thoracic Society that surveyed all of the pulmonary rehab programs in Canada. And we asked a whole bunch of different questions, but one of the things we were really interested in was how programs were delivering the muscle strengthening/muscle resistance training aspect of their program and how they were actually developing the exercise prescriptions for those programs. And that survey showed that this is actually, at least in Canada, an area of pulmonary rehab program delivery that's not that well developed. And we also, in the past, Gail and I delivered an in-person course in pulmonary rehab and Gail led the instruction actually related to the testing and training, and Gail you've advocated for the use of the modified One Rep Max Test as really a feasible and accurate test for use in pulmonary rehab. So I thought this would just be a great topic for the podcast, but before we get into that, I know you have many research and teaching responsibilities in your role as faculty member at Dalhousie. And you've also been the co-chair of the COPD assembly for the Canadian Thoracic Society. So could you start by giving us an overview of some of those projects that you've been involved with?

Dr Gail Dechman:

Sure! I love teaching, as you know, and so here at Dalhousie I teach the cardiorespiratory content. And so that's a two-course tandem kind of thing where we do an introductory course on acute care, and then we get into really management of people who are living with cardiorespiratory disease. So that includes people with COPD, CF, interstitial lung disease, chronic heart disease, chronic heart failure. And I have until very recently also taught exercise physiology, and I just love that herring of those two courses, because it's an excellent way to give clinical context to the exercise physiology and conversely, to reinforce the application of the principles and theories of exercise physiology to clinical practice, which I feel is so important. My research, as you've said, I really focus primarily on people with COPD and I'm very interested in functional outcome measures, but also thinking about ways of linking that outcome measure to exercise prescription, as well as being able to assess improvement or change.

So you and I were involved in a multicenter research project, which was really quite fascinating and fun where we looked at the validity and reliability of strength and power assessment tools in people with COPD. And I think we had some really excellent insights that came from that project. Also, I think maybe our listeners would be interested in the review article that was associated with that, which really reviews testing modalities, and that was published in the Cardiopulmonary Physical Therapy Journal. And maybe we could put a link to that because I think it's a great simple resource tool for people. More recently I, of course, have grad students and I've been really excited by a project where one of my graduate students looked at the validity of a tool to assess lower extremity multi-joint extensor power, and that's a bit of a mouthful, but really we know the power is more relevant to function and that it declines more quickly in older people or as we age, and we really don't have any good clinical tools to do this. So her study looked at being able to measure that power objectively using a leg press that you might find in a clinical practice and comparing it to what we call the squat jump test, which is surprisingly the gold standard. And she showed that there was a good agreement. So that's really exciting because I think it opens up a whole new realm of where we can go with assessing lower extremity power and then trying to rehabilitate it and see how it connects with function in a much more objective way.

And I am going on, you know, I do this Pat, but indeed my work with the COPD assembly, I have to say that I've been really fortunate to work with a lot of very talented and gracious people who share their knowledge in the assembly. A project that I think is great that came out of the assembly was the project on quality indicators in pulmonary rehab, which really was a spinoff from our PR survey. And again, I think it would be a great resource for our readers because it provides really clear guidance on all aspects of setting up and conducting a really high quality pulmonary rehab program. And as I said, it's pretty clear and concise. So, you know, great resource, really great resource. Of course, more recently we've been publishing guidelines and advice on COVID management for people with COPD and in pulmonary rehab. And those things are also really exciting to be part of and useful. And I think I should probably be quiet and let you ask your next question.

Dr Pat Camp:

No, thanks for that summary. And I'm going to put the links to those resources in the show notes, because I agree a lot of what you've mentioned we've actually have talked about on the podcast, especially the quality indicators and absolutely there's so many resources that are now being created for clinicians that are very usable. They can be implemented into clinical practice. They're really meant to not just make them stuck in a research lab, but definitely be appropriate in the clinical setting. Now I think that most of our listeners understand, of course, generally the importance of muscle strength or muscle power for people with chronic lung disease, but they might not appreciate all of the important benefits and how they actually improve healthcare outcomes for patients. So what are the benefits of having, you know, good power or strength in your upper body or lower body or core if you have chronic lung disease?

Dr Gail Dechman:

Yeah, well, there's a big topic, but maybe start with lower body strength because it's what we know the most about. And there is just no doubt that lower body strength, and really to a greater extent power, is very closely related to function, so that our ability to do a sit to stand task, and that's not just, you know, standing up from a chair, but think about other things like getting on and off a toilet, also going up and down the stairs, all of those things are very closely linked to strength. And so if we want to keep our patients or clients, I tend to call them patients, functional and able to live at home, then we need to think about those tasks and think about building strength. So much of pulmonary rehab, as we've talked

about is focused on our aerobic capacity. And sometimes that is the uncomfortable part of exercise training for people. So that strength training may be a little more attractive to people. And really from a functional point of view of just being in your home, very, very important.

Upper body strength, again, very important, but we know so much less about it. It's really interesting. I don't think except perhaps in spinal cord populations, most areas of rehabilitation had focused very much on upper body strength. And interestingly in pulmonary medicine, mostly we don't assess strength. What we do is we assess endurance so that our tests look like dowel lifting up and down (9:50). And this is really not what we use our arms for, particularly not functionally, we don't do that! We use strengthen our arms to lift things, to lift our groceries, to lift pots and pans. So once again, I think we owe it to our patients to focus more on upper body strength.

I think maybe in pulmonary medicine, one of the reasons why we haven't focused so much on the upper body is often it relates to activities of daily living that women perform, those things around the house, like lifting pots, carrying groceries and things. And for a long time, we assumed that women didn't get COPD, our biggest group in pulmonary rehab. And I think too, that's another reason why it hasn't been a focus for us. We know that isn't true and hopefully we'll be able to change things. We also don't have good functional tests for the upper extremity. There are some out there, they're a little complex, but hopefully a growth area. And core, oh my goodness core. I don't think any of us can deny the importance of core strength. But how to assess it? I'm sorry, I don't think anybody, not even the ACSM has a good way to assess it. Even though it's really difficult to assess, and I don't normally say this, it's important to have core exercises in our pulmonary rehab programs because we know that a strong core is associated with good balance. And we know that people with COPD are prone to falls and poor balance, and also having good core strength creates a stable base that facilitates movement of our arms and legs to do those other functional activities.

Dr Pat Camp:

Many of us really haven't received the education around muscle strength testing sort of formally in our original clinical education. And so, as we found out when we talked to clinicians and when we did the survey and what we've read, a lot of programs rely on a bit of a trial and error approach to exercise prescription. You know, they might have their patient lift a weight a few times and if that seems okay, then that will be our baseline and we'll go from there. But do you have any thoughts about the limitations of doing that versus creating an exercise prescription based on a validated test?

Dr Gail Dechman:

Hm, I certainly do! Because as you know, I really advocate for testing. Ultimately that approach is time consuming. And so for that reason, it wastes our time and it also wastes a patient's time and energy, and that is not a minor thing. But as you alluded to, the accuracy of that method is poor. And so, we are very likely to, not to be training our patients to best advantage and therefore their training becomes time-wasting. When you think about it, all of our tests, in order to have a valid and repeatable test, you usually have a standardized protocol and for any type of strength testing you have to think about your subject position. Are they sitting, standing, lying? And how do you standardize even that? You need to think about the speed of the movement, and the tempo of the movement. Joint position, and how much of the range of motion are you going to assess, all of it or just a restricted part of it? You need to think about the warmup, it should be standardized. Rest periods. If you're doing more than one set to get to what you want. Practice trials, we know that people learn how to do a movement and that they are able to lift more weight and that isn't a change in strength, that's just that they learn how to do the movement. Also even just the encouragement that we give people, no two people encourage the same way. And so that will affect performance. So many things. And even when we have a standardized

protocol, we don't do very well at those things, or we may not. But in trial and error, I hold that you're just not going to get things standardized. So you're unlikely to really get an accurate maximum, which is where we should be prescribing from. And it's probably not a reproducible.

Dr Pat Camp:

So there's quite a few different ways then that you can test, it sounds like, and obviously the different protocols that are associated with that. And I guess some testing of course works well in a laboratory. Maybe that's a better setting. And others are quite feasible for the clinical setting. So what are some of the ways that muscle function can be tested?

Dr Gail Dechman:

Well, as you suggested in the lab or in some sophisticated labs, we have very sophisticated dynamometers that we can use, things like the Cybex or the Biodex that people may have heard of. And in some sport training facilities, they may have this kind of equipment. But generally speaking, it takes up a lot of room, it's very expensive, it takes a lot of training to learn how to use it and then to interpret whatever information you get from them. And so, they're really not great clinical tools. They are valid and reproducible, so for research it's great, but for clinical, not really.

Clinically I think the most common tool, or at least the one that people may have heard of the most, is the 1RM, or the direct one repetition maximum. And this is the most weight that you can lift only once through full range and in good form. And that does give you the maximum weight, and then you can prescribe in terms of that maximum as we should. But there are a number of downsides or limitations to using a one RM, particularly in our population, who is not necessarily used to lifting weights. It can be dangerous. The chance for injury is quite high. People may lose control of the weight. And even with the spotter, they may injure themselves because you're trying to get the maximum weight. If we go too high, certainly injury is there. The other thing is that, what you should do is you do some familiarization and then you have somebody lift weights that are well below what you think their max is. So again, they're learning how to do this movement, and then you try and bump up your weights to the max. So in most cases, if you use it in a research environment, it actually takes two sessions. So you do a training session, so that somebody really knows how to do the movement, and then you do the test. And that's time consuming. If you don't do that, you're probably not going to get a very accurate one RM. So there are downsides to that, time consuming, injury.

So those are the most commonly used ones, except of course, for my favorite, which is the, we call it the **indirect one RM**. So it's a way to predict the one RM using a sub max weight and a number of repetitions. And so that takes away a lot of the potential for injury. It's very doable clinically. And in some ways it can be used, sometimes we don't like testing because we think it takes away from training, but really, your test can be a bit of training as well. So what we ask our participant to do, we give them a little bit of training with a very light weight, and then we give them a weight that we think they could lift between 2 and 10 times. And the goal is not to go over 10 times. And so again, they have to lift full range of motion and in good form. And as long as we're between 2 and 10 reps, we can predict, using a very simple formula, their one RM. And research has shown the prediction is really quite accurate. What we do here in my lab is we've just created a little Excel sheet, so you just have to put in the rep and the weight, and it spits out the one RM. It's really easy.

Dr Pat Camp:

So this is an indirect one RM. So you take a reasonable, you decide based on your clinical judgment and what the person tells you, what they're able to do functionally, and you pick that weight. So say, you

might look at me and say: "Okay, you look like you're in this sort of health and this sort of fitness level, and we're going to do your biceps. So I'm going to give you, I'll give you 10 pounds because I'm not sure about how strong you are, as for some of the things that you've told me". And so I would start, and then what happens as I go past say my second or third repetition? What are you looking at as the clinician?

Dr Gail Dechman:

So I'm looking at your form, and if you're doing this in standing, I'm looking for trunk motion. Are you trying to use your trunk, you know, to help you lift? Are you shaking? Are you able to get through that full range? And importantly, if you said at two or three, but if I see by rep five or six that this is easy for you, then I'm going to stop you, because I don't want to incur fatigue that's not useful, I'll give you a little break and then I'm going to up the weight again. So, you know, 10 is obviously too light for you, I'll give you 25. And remember, you only have to get two or three reps, that's it! You want to, at least to see what the form is like, I think, but after that...

Dr Pat Camp:

So you don't have to go to the 10 reps.

Dr Gail Dechman:

Nope. You don't.

Dr Pat Camp:

So what equipment are you using to do the test?

Dr Gail Dechman:

Typically we use handheld weights, but if you were in a gym type of facility, you could use your machines at the gym as well. Now they don't often give you, this another good thing about the indirect one RM, they don't give you much of a gradation. If you're doing some kind of a pull down or something, you know, maybe it's only 10-pound gradations, or 15. But remember, you only have to go less than 10 and you're okay. So it really gives you a lot of flexibility that way.

Dr Pat Camp:

And so if you wanted to do lower extremity testing and you didn't have that kind of gym equipment, is there anything that you can use to do the indirect one RM with the lower extremity?

Dr Gail Dechman:

Well, I think for some things we can use, again, it's not my favorite, quads, you know, knee extension classic quads over a roll or that kind of thing. I don't have great knees and I find that very uncomfortable and I'm probably a lot like some of our patients. I think you could maybe do a squatter, a sit to stand squat and sit to stand are really the same. If we think of squat as being something that athletes do and sit to stand as something that older people do, but that's not really true. So I think that you could do that and perhaps you could use some weights, either a weight belt around the waist or something over the shoulders that might help in that respect, but it is less accurate, that's for sure. And that's why, you know, I really wanted to get at that multi-joint extensor power with my grad student, because that's really what we do with our legs.

Dr Pat Camp:

Are there any contra-indications to doing the indirect one RM or situations where it just might not be useful?

Dr Gail Dechman:

Hm, I'm the wrong person to ask! (laughs) That's an interesting question. Certainly compared to the direct one RM no, because I think that the thing that we're most concerned about is loss of control of the weight. And so when we're doing the indirect we're using so much less weight that I think we really get rid of a lot of that danger. You can't say it's none, but we get rid of a lot of that risk of injury. Injury associated with the weight just being too heavy and losing control, or sometimes when a weight is too heavy, we all employ compensatory mechanisms to help us lift that weight, which may indirectly cause injury. That I really haven't seen using the indirect one RM. I don't know, help me out on this one. Do you have any thoughts about that?

Dr Pat Camp:

I think that you've really nailed it, that, you know, if the person is in the program and is going through the testing, you know, this offers the potential for less injury and with the same amount of accuracy. And so I think that's fantastic and also would improve upon the trial and error because you are picking a lower weight than you would for the maximum. And so I think it has a lot of really interesting utility. How long does it take to do the test Gail?

Dr Gail Dechman:

Say for your biceps?

Dr Pat Camp:

Yeah.

Dr Gail Dechman:

Oh goodness. You could probably get through that in, hm, if you're doing a properly, you'll do a warm and a familiarization, which add consent to it, and you're probably looking at say two minutes. And then another two minutes to do the test itself. So not very much. I mean, it's about the same as your trial and error only, probably less.

Dr Pat Camp:

One thing that's always been challenging for rehab programs is that we do test with one piece of equipment. Then sometimes we need to train with a different piece of equipment, and then we send people home and then they have potentially different equipment. So not even, you know, specific to the one RM or indirect one RM, but do you have thoughts about how we in rehab programs can deal with this really major challenge that faces us when we're trying to help people improve their muscle strength and or function?

Dr Gail Dechman:

Yeah, I think you have just nailed the critical question here because we do want to wean people off being dependent on us. So we always want them to be doing something at home or in some kind of community center or gym facility, whatever. But lots of times our patients prefer to be at home and therefore their weight is, particularly strength training is more challenging. So it really is a difficult

question. I think I would always prefer to test using, say an indirect one RM with weights where we actually know the weight. And then we get into, okay, it's the elephant in the room: bands. Because bands are great. They're light, portable, easy to use, and you can just adapt them in so many different ways. Really creativity is your only limitation for bands and you can use them for upper extremity, lower extremity. You can get core work in there. So they are fantastic.

Now having said that, I am not a lover of bands in general, but I see the utility of them. I think when we're using bands, we need to remember a couple of really important things. And this is why I would say, if you have the ability: test using a known weight, as we've been discussing. Because as bands get old, they don't offer the same resistance. And the resistance that a band offers changes with how much you stretch it. So, you know, you can have two people and if I have a particularly long arm, then the band is going to offer me a lot more resistance at the end of my range than somebody who is half my size. Or where you put the band, you know, is it at the ankle? Is it halfway up the thigh? If you're doing a knee extension, all those things make the resistance that a band offers highly variable. And for that reason, I don't think it's a good testing equipment. But there is no doubt that they're good for home use. And you know, you can make them quite functional, in some ways the activities you give people can be more functional than just a barbell weight. I would say though, that because of those considerations that we've talked about, about position being so important and where the band is placed, now that most people have cell phones, I would really recommend creating short video clips for patients with a commentary so that they do the exercise properly. Because those line drawings that we tend to give people, I can assure you that they don't understand them. My sister recently came home with some, and she said, "Gail, what are they telling me to do here?" And it's true. It's hard to understand. So why not get going with our technology and use it in a sensible way? The other thing about bands is they can slip. And so I think you need to make it clear to people about the problems associated with that as well.

Dr Pat Camp:

So it sounds like you're suggesting that we could use the indirect one RM to test people initially and also be able to use the similar equipment to create a training program. And that would be based on a valid test with a good exercise prescription. But you can also use bands as well in there and to get people, you know, to get a sense about how they might continue on with home. But then when you go back and test at the end of your program, to be able to show the patient how they've improved, to be able to report it - I think really important reporting that, you should go back to the indirect one RM and use that as an outcome measure. So the patient can train one way, but be tested a different way.

Dr Gail Dechman:

And I think the other interesting thing about that approach is we will get a better idea of what band exercises actually offer us. And, um, you know, again, add to our knowledge base.

Dr Pat Camp:

So what else should we know about this test, you know, in terms of the exercise prescription or other resources about how to do this test and other tests, what other kind of pieces of information or knowledge have you found to be really helpful as you teach this to clinicians and your students?

Dr Gail Dechman:

I think once people see the test, it's pretty obvious what's going on and I do have a video that I use for teaching. And, we could post that if that if you think that would be helpful. I like to use the Brzycki prediction formula, which I could also send, but actually probably a better thing, I have a great review

article on indirect tests and it includes Brzycki, and a couple of other ones, and that might be useful. It gives the prediction formula and really it's very simple. I think one of the things generally about strength testing that applies to our patient population and to a lot of populations of perhaps individuals who are frail, and many times our patients with COPD are frail, not always, is we really tend to underestimate what they can do. And so, you know, as you said, we look at somebody and, if we're incorporating strength training into the warmup or the cool-down, we give them a couple of pounds, two pounds, three pounds, and we're off to the races, but most people I'm telling you, most people can lift way more than that.

And so that's one reason to test is to really get a much more accurate perspective on what people can do and the ACSM and other professional organizations recommend that you start at 60% of the one RM, even in frail populations, remember 60% of 10 pounds is 0.6, you know, is six pounds. So we think of 60% or even 80% as being huge, but it's of their maximum. So it's with respect to them. And I think we forget that and we go, "whoa, 80%, no, no, no", but people can do that! So, you know, you should be starting at 60% of the one RM and they only have to be able to do a couple of reps and they'll get better and better and better. So you're aiming for 8 to 12 reps at 60% of the one RM, two or maybe three sets. And then you can progress from there. You can just redo your test. So I think our approach to strength training has not been very methodical.

Dr Pat Camp:

I think it has been an intimidating area for people. I think that programs really reinforced, a lot of our papers reinforced, and our guidelines reinforced the aerobic parts of pulmonary rehab and the importance for people to be able to walk, and it's certainly a very functional activity. And when programs only have an hour, I think that the muscle strength part of the program might not exist. If it does exist, it's like you say, people sitting in chairs with a two-pound weight doing what's basically calisthenics and it doesn't have to be that way. And I think having a test like this indirect one RM that you've described just gives clinicians, I think, the ability to have a test that they could do in short time. They can not take a lot of training to learn how to use it. And I would say, you know, I think we both talked about this, just start slow, pick one patient, practice, just go to the paper, figure out what the exercise prescription would be and how you'll do it. And, and you don't have to feel overwhelmed about testing every single muscle.

Dr Gail Dechman:

No, no, no, no. Not at all!

Dr Pat Camp:

Pick biceps, you know, quads, like just keep it basic and just get it going and keep track and talk to your patients about why you're doing it. And they will get excited to see their strength improve. We know that it also improves cognitive function, especially in older people, improves their quality of life that helps with, like you say, all of those functional activities. I mean, there's no reason not to do it. And we certainly don't want to under train people if they give us 6 to 12 weeks of their life.

Dr Gail Dechman:

Yeah, exactly. I mean, I could be really a bit of a rebel and say that our aerobic training is much simpler for people to do from a technical point of view. Whereas the strength training, people need some guidance and, you know, maybe we should think about transitioning faster from the aerobic component that we supervise. Transitioning that into a self-management and giving us more time to do strength training. But I realize I'm being a bit of a rebel there. I think the other thing that we need to think about

is that a lot of us in pulmonary rehab haven't done strength training ourselves. And so we're not very comfortable with it. And therefore we are perhaps reluctant to try and teach somebody else how to do that. But these are very simple movements. It's not like going to the gym and doing very complex things. It really isn't. And there are a couple of resources out there. The ACSM guidelines are a fantastic resource to use, and I would recommend people get a copy. It sort of is the Bible, it's quite conservative. So it's a safe reference as well.

Dr Pat Camp:

Gail, I just want to thank you so much for taking the time to talk to us today. You've provided us with a wealth of resources and we're going to put the link to those resources that you suggested in the show notes. You talked about papers, different organizations like the ACSM, you've offered us a video. And so for those of us where this still seems really confusing about how it is actually done, you can watch Gail and her colleague actually do the test in this video, including the instructions on biceps. And I think that you'll find, it'll make a lot more sense about how you can actually put this into the clinical practice. And if you want to hear more about Dr Dechman's research, you know, I'll also put the link to your faculty website in the show notes so that you can have a look at some of the really interesting projects that have been done by Gail and her colleagues. They look like they're a really interesting intersection between the exercise physiology, like you said, and how that really relates into two important health outcomes for patients. And I think that's just really exciting and a wonderful compliment to the podcast. So I'd like to thank you for joining us today, Gail.

Dr Gail Dechman:

Thank you for giving me the opportunity. It's been really fun. It's always fun to talk with you and to talk about strength, training, and care for people with COPD. So, thanks very much!

Dr Pat Camp:

Thank you. And until next time everyone. Keep moving and be safe, and we'll see you at the next episode of lung fit. Bye for now.