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Strength Training for Different Populations

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- [Carolyn] At this time, it's my pleasure to welcome back to physicaltherapy.com Dr. Amy Ashmore. Dr. Ashmore holds a PhD in Kinesiology from the University of Texas at Austin. She is the author of dozens of articles, blogs and continuing ed programs recognized by NSCA, BOC and many others. She is a former Sports Sciences faculty at Florida State and the former Program Director for Sports Sciences at the American Military University. Dr. Ashmore we're so excited for your presentation today and at this time, I'll turn the microphone over to you.

- [Amy] Hi, guys, thank you. Thank you for being here on this holiday weekend. I'm excited to see so many people from my original homestays, we're talking about Florida especially in Tallahassee, great memories Florida State. So we will be today talking, about specifically Strength Training. The reason that I didn't title this as resistance training in general is I feel like that most of you guys in a physical therapy setting, your primary outcome is strength, versus in sports performance, we might be looking more at endurance and/or power is probably our biggest and most important outcome. And we'll talk a little bit about that when we get more into different populations and training for athletes. Which is something I do want to bring up as a disclosure.

My most recent book "Timing Resistance Training", was released last week by Human Kinetics. I will refer to that only when, we're talking about sports performance, since it is in that category. So I'm very, very, very excited to be with you guys today. I'm excited that we have so many people here. Before I go through the learner outcomes, I do want to encourage you at any point in time to pose a question. I believe that the content that we're talking about today really lends itself well to active discussion. So at any point in time posing in that Q&A, I've never as far as I know not been able to see that and address your questions in real time and possibly open up a new dialogue that would be interesting to everyone. So first, let's go through our learner outcomes and then we'll just jump right into our content. So number one, we're going to identify contemporary research findings, for developing strength training sessions and

programs for different populations. Of course, outcomes are different and some methodology is also going to be different. Second, we're going to discuss designing, strength training programs specifically, for the obese population since we're up around that 70% unfortunately of persons in the US being either overweight or obese with I think obesity edging 37/38 right now. This is a huge population that we deal with a lot in fitness, of course, internal fitness environments but I'm sure in physical therapy is something that you are seeing more and more frequently as well. We'll also look at designing strength training programs, specifically for the healthy adults.

And when I speak of healthy adults, I'll define them a little bit more when we get to that component. But in my opinion, we're probably looking more at a difference on between weight classifications and metabolic syndromes, that type of thing between the obese and then the general healthy adult. We'll also be looking at designing strength training programs, specifically for the athlete. Now, when we're in a sports performance category, yes, absolutely we're talking about athletes, competitive athletes. We're also talking about serious recreational athletes and serious fitness enthusiasts because definitely their fitness profiles would lend to say that they were as fits and capable as someone who's a competitive athlete.

And finally we'll incorporate current recovery and flexibility training guidelines, into strength programming for different populations. So those are our outcomes, we'll bear them in mind as we go through our presentation and our session and in reality, hopefully, I've built the presentation to be fairly tight around these outcomes. So, just on the outline the way that I do this is I know we all know what our strength training programming variables are but just for the sake of operational definition and consistency, we will review those. I define them according to classical periodization training so we'll just review those, make sure we're all on the same page. And it's also important when we do look at some research that we all have our terms on the same page. Strength training for persons with obesity, we'll go through some contemporary

neural research in that population and how that's going to affect how we program for the obese along with some other practical considerations. We'll also look at, again, the strength training for healthy adults and in there we'll look at concurrent and combined training programs that as we move into strength training for athletes, we'll veer away from.

So we're definitely gonna look at different methodologies for strength training, for different populations and we'll support all of that with some contemporary research. We'll finally wrap up flexibility training guidelines and I usually incorporate those simply because flexibility when we do it and how we do it plays such a huge outcome, especially for athletics in relative to competition when we do it and how we do it. So I enjoy always including flexibility as well. So let's start with our programming variables and again, I'm fairly certain that all of you have a working knowledge of these but I just wanna make sure, we all have the same operational definitions.

So the ones that will be going over, of course, is your mode or your type of training. We're Of course dealing primarily with strength or resistance training for this particular session. We will though of course include flexibility into that as a mode but we're also going to look at a little bit of cardiovascular training because when it comes to athletes, it's so critical as to how we program cardiovascular around strength so that we don't impede strength gains so we will look at more than one mode. Frequency defined of course as the recurrence of sessions and that builds in your recovery lengths. Now for most people of course frequency, is gonna be one time per day.

Once we get into athletic training, we're actually looking at multiple times per day so when we look at those recovery lengths, we're looking around ideally three to six hours between sessions. We prefer six but we need at least three so those are the types of things frequency is defining. We'll also look at rest periods over days as well. Duration, oh, I see we have one, one, one, there should be one, two, three. Duration of course, is

gonna be your length of program which can be when we're looking at classical periodization training that can go up of course to a year. In reality in most settings, we're looking around 12 weeks, eight to 12 weeks. Each session total so how long is the session? About 45 minutes I think is around typical to 60 and then your session component. So if you do have your mode, you're doing concurrent training, you're doing strength, flexibility and cardio, how are those broken up timewise?

Again, four, four, this should be four and five. You have your volume, which is of course how much so that can be within strength training which we're really looking at, how many sets and how many reps? One thing I'll say, up front is when it comes to strength training, I don't deal in timed like, you'll see some models who will say do as many reps as you can in 60 seconds. The research always quantifies in terms of sets and reps so in the field I deal with sets and reps not a time parameter. My other concern, of course with time is mechanics and also we can't quantify or hold steady across 60 seconds, each person doing the same amount of reps within the same mechanics.

When you have volume you can also be talking, about your cardiovascular programming, you can be talking about distance and/or time which become really important when we're looking at programming cardiovascular gains that don't work against our strength gains. And finally, of course our intensity is how hard the individual is working as a measure of heart rate. This acronym stands for Muscle Force Generation Capacity or simply muscle output.

So how much force is that muscle generating? That's how we would quantify that in our strength training environments, your intensity. I pretty much went over all of these off the top of my head so your type of training, cardio, strength, flexibility, you guys know those. Your frequency days per week, within days your rest days, your duration, volume. Again when it comes to strength training I'm really big on sticking with sets and reps and my opinion is it better coincides with the research and again, we can

control the quantity and we can better control the mechanics. Your cardiovascular is your distance and time and just keep that in the back of your mind. I know you're you're like, well, we're talking about strength today and we really are focused on strength gains and strength outcomes but what we know now is that if we really want those strength gain outcomes, in athletes especially we have to be really really really conscientious as to how we develop the, corresponding cardiovascular component of a program and we'll go over that in detail.

So, how hard you're working as a measurement of strength and how it is defined. We can utilize both external weight which is gonna be of course, our barbells, dumbbells, machines, bands, whatever that may be and also body weight. Body weight training is a huge, is very popular and very effective so when we define intensity at the muscle level we're looking at the speed and/or velocity of muscle contraction as well or the speed again on a cardio machine which again is gonna be really important when we look at not interfering with those strength gains but utilizing endurance work to build muscle endurance which is necessary for strength training. So, we're gonna get really specific, on some of these variables.

Now, as we define strength training, of course, here we do have a body weight only example. The way that I define resistance training for strength, would be that you are utilizing any number of these methods. So for external weights, dumbbells, barbells, machines, bands, medicine balls, kettleballs, ropes. Body weight gravity use, plyometric drills which may or may not be weighted, that's gonna be a whole nother ballgame. One of the things we'll get into, when we get into external weight sources, when we talk about machines and when we talked about training for persons with obesity we will actually find that of course machines can be impediments, unless they're built specifically for larger sized person. So that is how I define strength training or resistance training. Key concepts, again, the muscle strength is defined as how much force a muscle can produce. So that was that acronym back a few slides ago,

Muscle Force Generation Capacity is how we measure that in a laboratory setting. We'll talk a little bit about the realities of measuring these outcomes in the real world a little bit. So muscle strength, of course is typically measured by that one repetition maximum in laboratory settings and gym settings with highly condition persons because the one repetition maximum, is basically taking a lift, typically a bench press or squat and maxing out.

You take that person where that's the last heaviest amount of weight he or she can lift for one rep. Well, of course, I mean, the first thing you're thinking, just like me is, yeah, I don't think I'm gonna do that with most people I know. That's a pretty intense measurement of strength which is fine for a college level offensive lineman but this is not always a safe and viable test in the field. So sub-maximal measurements have their place in the field and they're fine. I rarely myself feel comfortable out in a field outside of a lab setting where I would have, or a athletic facility where I'd have a lot of support doing a one rep maximum.

So these sub-maximal measurements, definitely have their place. I'm gonna give you a resource for those in a second but when we do talk about utilizing sub-maximal, versus maximal strength measurements, the reality is that in the field and in performance settings, athletic settings, outcomes are more important, than absolute strength, of course. So the capability to move quickly is far and away more important to an offensive lineman than the capability to produce as much strength as possible in a laboratory setting. So to ensure the validity of a program in the progression of a program and/or client or athlete in the field, you would use reliable and consistent measurements of strength. So as long as they are reliable in terms of you're using a recognized method, you have this relatively the same testing conditions and the same tester. That's always huge because the way I test and what I get might be different than say a colleague. You wanna test as we look at timing parameters of resistance training. At the same time of the day, we know for example that muscles are their most

pliable around four to 6 p.m. We know that most world records, in athletics are set around that time. So you wouldn't wanna test initially at 8 a.m and then turn around and test at 4:30 p.m. So consistency I believe is more important, than the absolute strength measurements.

As long as you're demonstrating, an improvement in strength, you're reaching your outcomes. Most strength coaches work specifically, within their defined realm and then send that athlete onto his or her sports specific coach. So as long as the job is being done to improve the strength, the measurement of strength, then we're on task in preventing injury of course as long as we're not doing anything that's detrimental. Of course, muscle strength or performance needs to correspond really well to a functional fitness or athletic goal. So having said that, again, absolute strength is not really what you're looking for, you're looking for some improvement sit to stand and functional, some improvement and even cardiorespiratory fitness or an athletic training goal or outcome.

So of course, we all know that strength development is related to two primary factors. Neural factors and hypertrophy or mass gains. These will become really important than all factors, when we look at aging and when we look at obesity and of course beginning fitness. Hypertrophy is gonna become more important as people adapt to the initial motor learning aspects of strength training. So early on in exercise training, muscle gains are due to neural factors and I believe most of us know that, especially where children are concerned, elderly are concerned and people who are new to fitness.

And of course, the reason is pretty straightforward in terms of motor learning. With practice which is repetition, the brain gets better at sending signals to the muscles it needs and recruiting the targeted muscle fibers, for the desired movement. So it's essentially a learning phenomena. So we can see in their first three weeks of fitness it's

not atypical for us to see a marked improvement and what we perceived to be strength gains but they're neural factors, they're motor learning factors, we haven't began to see the initial hypertrophy take place but we've definitely began to see strength improvements where people can lift heavier weight almost immediately and that's a motor learning phenomenon.

So again, during those first three weeks, those strength gains are due to learning. Another factor that's really important to those of us who live in the strength training world of course is we don't ever hear enough about testosterone and human growth hormone. Well, when we're talking about initial gains and strength and gains and strength in children that have not yet reached puberty and the elderly, neural factors play a huge role because of lower levels of testosterone. So that's also something to bear in mind as you're dealing with these different populations. They're having different methods of underlying improvements at the endocrine level, at the muscle physiology level, things are improving for different reasons.

So, Strength Training Programs for Persons with Obesity. I start here because it has some interesting, neural factors going on here. And also, it is something that we see 70% of people struggling with right now, maybe not in the obese category about 38% but when I'm in gyms, I've spent 30 years inside big box gyms. Gold's is where I started, spent 24 hour big box gyms, I spent a lot of time in and some of the ways that I tried to help trainers and produce content that helps fitness trainers, not necessarily physical therapist but especially beginning fitness trainers, I try to write a lot of content for is by watching them interact with clients when they have no idea who I am and coming up with hopefully solutions that will help them and one of the most common things I see, is a younger trainer, a new trainer working with someone who's struggling with weight management. And you see some really practical dilemmas and for that reason I start there. So when we're working with persons who are struggling with obesity, I kinda go through a pretty specific format. We look at limitation, safety and

feasibility. These are huge, limitations are a big factor safety and feasibility that we don't even consider really when we're dealing with healthy adults, even active agers and of course athletes. Warm-ups become a big dilemma and we'll talk about a little bit, about that in a minute why. Persons struggling with obesity, has some significant neural changes that make working with them a whole new ballgame that unless you are exposed to this research you probably wouldn't think about and for good reason.

We'll go through some suggestive programming, some really simplified programming that of course you can build upon change, whatever you wanna do with that. And then think a little bit about, specific suggested strength exercises. Once you get in the gym everything changes with this particular population.

So the limitations, I always encourage people to think about the limitations upfront, before you even see the client or the patient because these are huge. These are gonna impact the way that you can execute any session with a person who might be struggling with weight management. The extra mass that they carry of course impacts, creates impact forces on joints that if you're a normal or healthy Weight, excuse me, you don't have. You have joint range of motion limitations, a really practical stuff like the ability to fit into a machine. If you think about a traditional seated leg press or traditional seated leg extension, knee extension machine, if you're over 300 pounds, maybe over 250, you're probably not getting in there.

So we have to come out with solutions. There are corporate solutions for those and I'll talk a little bit about those as well. The ability to get up from the floor, one of the things that I'll always remind beginning trainers is you don't wanna be doing a lot of contrast. Be on the floor then do a standing exercise or start on the floor and then try to go to different exercise. If you've ever watched a group fitness class, where people will have a lot of varying capabilities, getting up and down from the floor can be in and of itself a challenge. And we always wanna bear in mind the psychological factors, associated

with exercise and if you feel embarrassed or ashamed, you're not gonna wanna come back. The ability to stand from a seated position, again, not quite as severe as the floor but it can definitely be a factor. Full range of motion to bend over or fully complete an exercise can sometimes even or most of the time become a severe impediment.

And again, the ability to move around the gym quickly and easily. I usually recommend setting up a station and just kind of staying there. So here's our data on the joint. So when people who suffer from obesity walk on a treadmill at a set pace, the vertical or the downward loading forces on the knees are greater than that for healthy weight people. So we know that so this increases the load on the joints and contributes to knee degeneration or breakdown over time.

We know that but in the back of our minds, most people are typically thinking that walking is a great exercise for persons who are struggling with weight and it's also sometimes the only available machine, for warm-ups with this population. That becomes a significant issue. Most major treadmill brands manufacturer today, tolerate weights up to 400 pounds easily. When I've spoken to manufacturers, Elliptical trainers tend to be similar but not always. I would recommend the larger manufacturers, for Elliptical trainers if that's something you're gonna try with someone struggling with weight. If not SCIFIT is a company that develops equipment specifically for this population. They have a line of recumbent trainers that allow users up to 650 pounds to enter the swivel chair and sit comfortably and exercise.

So if you come across one of these, I always tell people this is probably your best bet and best solution for someone really struggling with weight management, this line of equipment is developed for them. Now, what I really find the most interesting, when I came across this data a couple of years ago is that research shows us that people who are obese have less white matter or neural pathways connecting the different parts of the brain or the gray matter than normal weight people. I personally don't know why if

someone does know why, please add it in the Q&A. Fewer neural pathways and connections mean that people who suffer from obesity might have a tougher time, remembering new information. Now, if we go back and we remember the motor learning changes or neural changes are the reason for most strength changes or adaptations in the first three weeks. We kinda have a social situation here because now where we should be really I will to get those gains were kind of impeded.

So what it's going to tell us is that the way that we program for persons with obesity, not just the exercises we choose, the equipments we choose and how we execute them but actually how we program and structure our sessions in terms of reps, sets that it should be slightly different, than when you're working with other populations. So what I have here and what I recommend utilizing at least initially is a very, very, very, simplified programming model that I call 2-2-10-20. It's very simple. The way that I would execute those is two exercises, select two exercises for the upper and lower body each and I'll have some suggested exercises a little bit later, along with two exercises for the core muscle.

So you select your exercises that you wanna do with this person up front. You do two sets of each exercise and you stay on the higher end of your reps, so 10 to 20. And the reason is if you know that learning might be challenging, you prime the neural networks, doing it more doing it over and over again versus, incorporating a lot of different exercises. This model a course, I would never suggest upper and lower for people who are really strength training regularly. Would be feasible for persons struggling with weight I believe and are typically new to fitness is they're gonna work out two to three times per week with weight most likely maximum.

So we're not having, we're not running the risk of of course any overtraining in terms of frequency. And typically our intensity or our way that we utilize is not prohibitive with this group that it would make a really simplified model, like this total body model

unrealistic. Oh, hey, Saucie, I hope I said your name right. I would start out with low to moderate intensity exercises with persons who are suffering with weight management and I would almost think of them more of a pre pubescent model where you're trying to teach the mechanics initially than you are trying to really build the strength, build the mass. They typically advance very quickly but the key is I believe initially that motor learning aspects to get them to learn the movements.

So we use a simplified programming model simply because focus of course lower intensity, higher volume, is a good place to start and we're not gonna run the over with the training or overtraining risk here. Repetition of course aids motor learning so long as of course that practice is accurate. When you do see odd mechanics, you do see struggling with mechanics that you're gonna wanna change that mode of practice of course. Neural priming, where you're essentially, priming those neural networks to teach them to recruit more, more effectively, the targeted muscle fibers to execute those movements.

And then something that I will usually I only talk about or will in this case today, when we're talking about strength programming is adherence. I'll only talk about exercise psychology in regard to this particular group because it is so important. Saucie I see your home practice. I tend to veer away from, unless it's something very simple, like, almost like isometric contractions, very simple movement, encouraging people who are very, very, very new to strength training to be training initially on their own with any type of weight or aid. I bet you can give homework that's practicing isometric contractions that will aid in neural priming that type of thing.

So when we talk about adherence for persons who are new to fitness and struggling with weight and probably, quite frankly, don't wanna be in a fitness setting. Some may but there's a lot of who don't, the adherence is a big issue. So you have what we call process goals, are a way for you trick of the trade to help you to work with these

people and we'll have some examples of those. So in terms of exercise psychology what we know is that process goals which are also termed micro-goals which are also termed session goal so all those things kinda travel in the same meaning. These are short term work out session based goals that can be reached right now. They help to improve self efficacy or the belief of course, that I can set a goal and achieve that goal. And it's really important when you're working with people new to fitness who are struggling with weight that they see some measurable outcome, some goal attainment pretty much immediately. They're not gonna see obviously, strength improvements immediately, weight loss improvements immediately but what I can see is execution immediately.

So this helps to improve both short and long term adherence to exercise. It is in contrast to vague hard to reach goals like I want to lose weight and tone up, nobody knows what that means. So an example of a process goal would be to complete 10 reps of wall squats or complete 10 minutes on the treadmill 3.5 speed. So these are something that you're building people's confidence, in literally minute timeframes. The case of 10 mile wall squats it might be seconds. So that's the key and we know that process goals are important and they are effective so you wanna make certain that as you design programs and as you implement them with persons who are struggling with weight management that you absolutely try and implement these process goals and it helps you. So when you select exercises for this population, select them based on challenges due to extra mass. You wanna avoid getting in there and then realizing oh, this is a bad one. Mobility issues, standing limits, use of interchangeable free weights, bands and body weight resistance, ease of execution.

That’s where you'll be looking at single-joint exercises in particular and the ability to alter the mechanics and range of motion easily. So select these open-ended exercises and free range spaces where feasible if not, you have benches, you have seats, that kind of thing, chair exercise, they can definitely play a role. So what I've done here is

just listed, some suggested lower body exercises. All of these of course can be Googled easily, you'll come up with probably 100,000 hits on showing the mechanics, showing examples, those types of things. The only thing that I will draw attention to for me is that I think to step up and down is a relatively advanced exercise. I've seen that go wrong pretty quickly, pretty easily where the exerciser is just not ready for that.

I also included some core exercises in here but again, and you also see where I have the seated knee the extensions, I have them on a bench or a chair because again if getting in the machine, might not be feasible but you can still do these in a chair or on a bench, that type of thing. Suggested upper body exercises. You'll see here that I've utilized an example of similar triceps overhead extension so a single-joint exercise. No harm, no foul in starting out with single-joint exercises. Single-joint exercises that the persons can easily execute. Again, that's gonna improve your self efficacy. And that's going to target or isolate muscles and that's gonna go back to your motor learning where you can easily practice these exercises. You can easily execute them correctly, priming those neural pathways.

And let me see what you got here. Hold on, hold on, and hold on, lemme go back up. Sherry, I see you. And there's, so Ann says there's one theory as to why there is less matter in the obese population or white matter. Hold on. I keep bouncing out the more hits I get. There we go. So Ann says there's one theory as to why there's less white matter in the obese population, which researchers think it may have to do with overall inflammation in both the DT, what does DT mean? In the both DT, the obesity as well as most studies are either diabetic. So, let's say that this is, an inflammation issue we're talking about. I think, they'll typically run higher blood, okay. I'm not I can't see in my question and answer box the whole, the entire response without it bouncing back up to like Sherry's questions. So Ann I'm gonna say that you're saying that the last white matter in the obese population is due to inflammation. I will see if Carolyn can somehow pull that whole explanation up for me to see and share with the group. Okay,

here it is. But it's only a theory at this point. Okay, thank you. So, inflammation we'll be looking at that. Sherry so test question number four. I am recommending, okay, so Sherry asked. So for question number four, you are not recommending a stepping up and down or a C-Leg press. Okay, that's a good question. Thanks for bringing that to my attention. I think stepping up and down is an advanced exercise but it's a good one for persons who are obese who have the balance and strength and the capability to do it because there are no limitations.

However, the leg press you want to avoid so the answer to that would be we want to avoid see the leg price and that's simply because if you guys are familiar with those, you get in there and you're kinda squished. So I had a couple of other questions that bounced out of my Q&A, that was cleared. So if I didn't get to your question, okay, Carolyn said that they were similar. Okay, so Neoka I hope I said your name right, per a research article in CBI site, white matter decreases in obese could also be due to abnormal cholesterol. So very interesting theories here as to why the white matter decreases, important to us that it does so that when we're working with these populations we need to be aware.

So Stacy asked, can we and this is relationship to the ex psychology, can we ask the patient to set his own limit on reps at the first session instead of few more reps as a goal next session? Instead of us setting a goal. I think that's a great idea so long as you so the question is basically, can I allow where interested the person to set his or her own, process goals for a fitness session? Absolutely, so long as within your professional opinion that goal is reasonable, safe and sound. So Saucie says that's what they usually do and it works perfectly for him and his patients so I think that's great. It's a great way to empower the client to include the client in his or her own efficacy. So adding variety. That's one thing that can be tough with the obese population because we have to add variety where we have so many limitations already and not make it obvious that we are limited. So change your mechanics slightly, vary

your arm positions during a squat. These are just really generic suggestions. Try wall squats with a physioball behind the lower back. Try hammer curls which of course just means thumbs up, versus standard bicep curls so just minor variations and actually these minor variations do change the mechanics and not to vary the muscle patterns of activation.

So they may look tiny and insignificant but they do work muscles differently. Vary the order of exercises. This is not a muscle performance environment, this is not elite or athlete where we're really under the gun here. Have fun, start with isolation exercises to focus on a particular muscle weakness or group before moving on to the larger squats that type of stuff. I'll start with core exercises, why not? Again, this population can be fun to work with in that regard that you're not so limited by outcomes and by these hard and fast rules because they're training so intensively. Yeah, Neoka says adding variety is what helped keeps them in the game and that's exactly right. There's no truer statement than that.

When you're working with people that I have to get reminded by my mentors, hey, Amy, everyone is not as into this as you are. Like, very few people are into this like you are so for me, I had to constantly be reminded of that and Neoka is exactly right, that you know, the vast majority of people are not fighting tooth and nail to get to the gym on the floor and just have a great time. So adding that variety, keeping things a little bit different but within their limitations is a fun way to mix it up and help them achieve their goals and hopefully to adhere to really keep coming back.

Other things, strategic timing, timing down to the microsecond is a huge issue for us now, in performance settings. We can also use some of these timing keys here, hold a peak contraction so that means that the top of a leg press, excuse me a knee extension stop at the extended position and squeeze the target muscle for a few seconds. Great for this population because it also reinforces that priming and motor

learning. Manipulate your counts to go four to eight counts on each phase for example of the up and down or prep power, play with it. Practice slow controlled movement, synchronizing breathing techniques to exercises. If you watch a lot of new exercises hold their breath so these are fun ways to just kind of mix these things up. And then Saucie also says which is a great thing that adding variety can be progression to the next level which is exactly true. Once you change the mechanics of an exercise a tad bit or change the timing, you are adding enough variability to for it to qualify as progression as well.

So tips and tricks. When we work with person struggling with weight we're gonna need a lot of tips or a lot of tricks in our bags. I always say if mechanics get off to stop where you are, return to have the client, return to the start position and began again because a lot of times the off is dangerous. There's no reason to continue. Just cease the exercise, return to the start position, set your start mechanics up and begin again. If the client is having difficulties executing a movement, try placing your hand on the working muscle and pressing gently. This sends sensory signals to the brain that says, hey, this is what's supposed to be working. This is where I'm supposed to be focusing and again, for this population, reinforces the neural priming tricks that we're trying the motor learning tricks that we're really trying to work on right now. If fatigue becomes an issue, don't worry about it. Use rest breaks, which is essentially where we stop, we rest and we finish the set hopefully of 10 when we can.

So we do those just like modified cluster sets, we'll do two or three stop, two or three stop that kind of thing. And finally, if you just really are in a bind, you can always do a drop sets which is just drop the weight to a lower weight and execute the set. I always feel like it's better to execute the number if we can then to focus on the way to the resistance. Yes, so Neoka also says that where someone learns incorrectly it can demotivate them. And that's absolutely true. We always say or I used I've said in gyms my whole life that if you get an advanced exercise or athlete who executes a

fundamental lift wrong, it's almost impossible, it's an absolute nightmare to unlearn, incorrectly learn motor skill and reteach it. So when we're teaching people who are new to fitness, we wanna make absolutely certain that we're teaching them correctly and when we're struggling teaching them correctly, we just move on. So we're gonna wrap that up on the obese. I know we can talk about that population for a long time and it's interesting but I do want for other persons who, we'll talk about a different population to go ahead and move on.

So Stacy, I do see your comments, unilateral exercises are great way to go for rest and recovery and we're actually gonna talk a little bit about, unilateral exercises versus bilateral and some research studies here in the next hour. So it's a good lead. So Strength Training for Healthy Adults. That's a big population. So defining healthy adults. For our purposes, healthy adults are any persons over 18, yep, in good health and not limited to a specific exercise programs due to health or mobility concerns. And this goes back to my training at Texas where we would have master athletes come in and just kill it in comparison to some persons that were our college student compares. So age is definitely never the defining parameter. So this is a pretty open ended population in other words.

So the research, the only research study that I really wanna cover on active aging today, is a new one from 2019 recently published that shows that plyometric training significantly reduces the risk of age related muscle loss. Of course you guys know about sarcopenia and release some of the associated negative effects of sarcopenia like loss of tone, strength and function which is huge for the active aging population and the aging population in general. I mean, as we get older it becomes harder and harder just naturally, even if we're in the gym every day to build muscle mass and good grief sustain it. So in this particular study, what they did was examine the effects of a plyometric program on quadriceps size and strength. Now I know what you're thinking. Yeah, plyometrics in aging populations, not sure I wanna go in that direction. Well, this

is where we're gonna have to do two things. We're gonna have to acknowledge that this was done in a lab and then kind of stretch our applications because the equipment that they utilize, we don't have access to because it was a customized machine similar to a leg press.

So stay with me. You take one of those little trampolines, little teeny exercise, they used to be exercises and the kids love them, those little teeny trampolines. And what's gonna happen is the exerciser is going to literally push off of that at an angle. So where traditional leg press has a sled coming down on top of you or right out in front of you, this particular apparatus is going to allow you to come down and bounce off at an angle. Clearly this is not a piece of equipment that we have available to us in workout settings today. So just bear that in mind. So you have 14 young men around 25 and nine older men around 70. What you're gonna notice here on your methods is two things. Number one volume is high. Your young group did four sets of 30 and then five sets of 30 the final two weeks.

So over a six week span, they did four of 30 the first four, five of 30 the second two or the last two. Your older men had a lower volume, they did three sets the first and four sets the second two or the final two weeks. The reason the training volumes differed was that the older subject showed fatigue in a pilot study. So the two volumes were different. I'm not sure how you qualify that but that's the reason that was stated but the volume is high anyway. So the results showed what we would expect that increased muscle mass that muscle mass increased in both young and older men and that the strength increased in both subgroups or subjects as well.

So it's not surprising because of course where you're using plyometric training, you're utilizing type II fibers which are known to be associated with growth and strength. And they're also known to be the ones that are preferentially lost in sarcopenia. So any increase in their cross sectional area, is gonna be significant. So this is exciting

because it does show us that in active aging populations plyometric training, can positively impact sarcopenia. I personally, as I reach a different phase in life, find this very exciting and I know the people who are actively aging do as well.

However the problem of course is that piece of equipment is not available to us and the safety is paramount because of course we start to see bone health issues, joint health issues as we age as well and jumping is not necessarily feasible for everyone. So, when I tried to apply this data, I thought okay where are some feasible places to start? How do we know when and how to change or when to change or to apply these methods a little bit more stringently? Number one, always strengthen the muscles that originate in the hips like the gluteals, quads, harms and hip abductors.

They're the largest muscles in the body and of course the ones that are utilized for plyometric drills. They also, you're also gonna wanna strengthen, those core muscles as well before you get started with plyo in the active aging. Now, how do you know that your clientele is suitable for this? For lower body speed, so this is called establishing readiness for plyometrics. So, for lower body speed, exercisers should be able to complete five repetitions of the back squat that's a traditional squat at 60% or more of his or her body weight within five seconds. And yeah, Marcia has a good suggestion that you can do these plyometric drills in the pool. My only question I don't know a lot about aquatics research but are the impact forces less? I mean, I know the impact forces are gonna less but are we still gonna have be able to exert the forces that we need to induce the fast twitch fiber changes?

So that's the question I'm throwing out there and if anybody knows the answer, definitely chime in. For upper body speed, you're looking at bench pressing five reps or more at 60% of his or her body weight in five seconds or less. So these are good indicators of, okay, when is this person ready? Now once your lower body strength has been developed which will be paramount of course, your readiness has been

established and balance is not an issue. Start with small range of motion jump squats and jump and reach drills. These are lower intensity starter, your starter package plyometric drills. And again, make your best decision if this is appropriate, if not back up and do something else. Now, the other thing I recommend is I say, well, lower body plyos are pretty advanced but upper bodies you can do like a kneeling ball pass, a medicine ball chest pass.

You can do that while in a seated or kneeling position and still get that upper body benefit that for so many people especially as you're aging you're losing, the triceps lose massive strength faster than any, muscle I know in a woman's body. I don't know for sure in a man's body but so upper body plyometrics have great value too. Let me see this other question Neoka. Yeah, I think definitely the pool as Neoka says due to you may be decreasing good stress on the joints and bones definitely. I would use a pool for those that require an environment to perform exercises pain free. So that is definitely true and then Lena said water adds resistance I didn't get the rest of that when I got cleared. Yeah, so the bottom line is, this is gonna be really individual in terms of how you apply plyometrics with active aging persons.

But I think just because we know the effects of sarcopenia on quality of life and functionality if we know we have a way through plyometrics to cease sarcopenia, we should always try these methods where the client and/or patient is feasibly ready. And again, I will start with upper body simply because you take balance out, you take impact forces out, those types of things. When you choose that upper body resistance, these are the two general rules. The ball must be heavy enough to slow the exercise but not so heavy to reduce the range of motion. So you got to stay in that full range of motion. The ball must not be so heavy that it makes it difficult for the client to comfortably control the ball for at least five reps. So when you're dealing plyometrics, the research stays within this five repetition range, in terms of establishing readiness and choosing resistance. So this is just a basic sample routine. I went if you notice, I

went down on your sets significantly or not significantly but I went down on your sets and I went down on your reps. So for me, I went back to a more traditional paradigm, than the researchers had used that very high volume paradigm. I personally felt like a lower volume paradigm, might be safer in a real world setting. The other thing is I also added in these suggested, between set rest breaks, I kinda took the happy medium, from traditional strength training environments and took it from 30 seconds to two minutes and of course that's dependent on the resistance and this being utilized in the fitness level.

And then of course, when we want to progress, I just say a simple strategy because the researchers did use such a high volume paradigm, I just said that we could add that fourth set of 15 after two weeks so I went kinda in the middle or 2/3, I broke their paradigm in a third, a third, a third and just manipulated volume here, versus manipulating intensity. All right so this gets I think more into, data research training methods that you can also utilize in your own life. Concurrent Training is doing multiple modes of exercise in one session to achieve fitness goals. Is a time record general fitness paradigm where you'll have somebody do 10 to 20 minutes of cardio and then they'll do like 20 minutes of strength training and then they'll do like 10 to 20 minutes of flexibility. Great for general fitness goals. Great for most of us. Is what probably I did for most of my own life. However, this is definitely not recommended for athletes or advanced exercisers with muscle performance goals and we're gonna get at why in terms of muscle confusion, interference a little bit later.

So this is your basic old school concurrent workout. It's great, get people in, do a little bit of everything and send them on their way. This will be your programming broken down a little bit more and again were you see wherever I combine upper and lower body under one workout, this would be actually your strength program. Again I'm thinking general fitness, I'm thinking people who are probably doing strength programming, three days a week. Not super high intensity is just is general fitness, this

is not set the world on fire at the Iron Man. So one of my more favorite, methods for general fitness concurrent training is what we call plyometric superset which is basically where you superset or do back to back a traditional exercise like a squat with a jump squat. So you're utilizing muscles in a little bit different way, you're getting deeper into those fast twitch fibers, without plyometric exercise and you're probably adding a little bit of a cardio component, great for concurrent environments. This would be a sample plyometric superset.

Again, your resistance is always gonna be determined by your person who's actually doing it. Your rest, because this is a general fitness connotation, I did 30 to 60 seconds. You can have people who are lifting very heavy of course, rest up to four minutes and beyond between even one rep, like a power lifter. So in this case, I'm thinking specifically general fitness, that type of thing. So those rest are gonna look different when you look at muscle performance goals. So that was our very brief start. We'll talk a little bit more about concurrent training last. Now we'll get into strength training for athletes. And again, athletes, I do wanna clarify, it's not just people who are competitive or college athletes, pro athletes. In our world, we also consider athletes to be serious fitness enthusiasts, serious recreational athletes. So again, these can be people you come across, on a daily basis as well. Remember, I talked about measuring strength and I had a calculation for you.

Of course, I included it with athletes your reference here and here simply because you don't see that too much in fitness environments working with people struggling with weight but once you get into serious athletes this is where they usually wanna know, you wanna know there's some accountability. So I did include for you here basic length which will tell you how to do those assessments when one may or may not be feasible or recommended, et Cetera. All right, we know hypertrophy increases massive of fibers. We are looking at muscle fiber growth. We're not looking at hyperplasia which is an increase in the number of fibers. That is not a factor in humans. The only data that

I'm aware of and this was just when I was at Florida State that I looked at, not last term but the term before was done with chickens. So not a lot of . When I looked last night because this is the one thing I was curious about, I said all right, do we have anything new on hyperplasia? We don't, not in skeletal muscle fibers. So our hypertrophy is the individual fiber expands and we measure that in some settings by just a cross sectional area. We mentioned testosterone earlier. Testosterone becomes a game changer when we're looking at muscle performance. We're not looking at just general fitness, we were looking at performance.

Testosterone becomes a big player as most as other endocrine profiles do. Testosterone levels naturally fluctuate throughout the day and that's critical because we need that testosterone level to be high to yield some of the growth that we want in muscles. So we need to know kind of when it's at its highest, when it peaks and how we can manipulate it. So its highest in the morning around 8 a.m and begins to level off between four and 6 p.m. And then decreasing after that in alignment with that's when most people's rest cycle is so they will go into a rest period where or sleep period where testosterone levels don't necessarily need to be high. Now, having said that, testosterone is not gonna be our only critical factor. Lemme just say really quick when we look at that four to 6 p.m that's important because muscles are most pliable at that time.

So a lot of reasons why we see muscle performance goals, being targeted at that time, that pliability improves their contractility which stretches the stimulus for muscle growth so you'll see the belief is the greatest benefit. Now testosterone levels can be manipulated by resistance training. How? By multi-joint exercises like squats and deadlifts because they are known to cause the release of testosterone and human growth hormone into the bloodstream that facilitate muscle growth, strength and power development. So in athletes this is really important. That's why you'll see most training programs where muscle performance is a big factor start with a squat to get

that hormone, the testosterone and HGH into the bloodstream. Now, when it comes to HGH, there's a little bit of difference here in that the eccentric or lengthening muscle contraction. So like the down phase of a squat causes more HGH release, than a concentric or the power or up phase or shortening contraction. So again, you want is you're looking at those endocrine profiles and you're looking at okay, how do I align those with my muscle performance outcomes? It's getting down into specific types of exercises, specific types of muscle contraction.

Of course when we talk about programming, we can talk about most athletic training programs, are facilitated by multi-joint or large compound exercises that will use complimentary single-joint exercises. Saucie in testosterone in female clients, free floating testosterone is not known to be such a significant factor. I'm guessing it would increase of course slightly relative to the normal endocrine profile of a female but not similar in absolute quantity or relative percentage to the male. One of the myths of course it's always, perpetuated in the general public is I don't wanna get big so I don't strength, I don't lift weights. Of course, those of us who've been doing it for a lifetime, recognize that you women don't have enough, free floating testosterone or HGH to get as large as you will see competitive female bodybuilders naturally. That requires exogenous testosterone, exogenous human growth hormone.

So, in females it's gonna be, a little bit different ballgame but it's gonna be relative. Good question. So you know your multi-joint exercise, is big compound exercises. Can I be heard? I'm getting from. Okay, Carolyn says yes, I can be heard. Okay, I had a couple, a point where I didn't hear the audio. Okay, good, all right, thank you guys, thank you. There's nothing like sitting in your office talking and then realizing you're talking to yourself so thanks. Neoka the short pause might actually be me. I don't know as I look back and forth. So compound exercise of course, your bench press, squats, et Cetera, you guys know that. Bottom line these exercises are limited by motor coordination. So you think back as to how we're talking about, strength training for

different populations. Now we're heralding the almighty squat, the almighty deadlift, I mean we're in power lift mode now. And we're talking about athletes, we're talking about serious recreational exercisers, people with 30 years of experience, versus when we were talking about program for persons with obesity, we were talking about limiting these exercises that require experience, require motor coordination, require knowledge and the mechanics and basic strength foundations. So, when you do those single-joint exercises they're great to build mass. We know that, but that's not most people's objective.

They're also again to fix a weak link, like say if a rotator cuff is limiting, the ability on a bench press, you fix the rotator cuff problem, before you keep moving forward on the compound movement. That's your example of a single-joint movement. We talked about the weakest link a little bit, this is just basically isolation exercises are good to fix that weak link, excuse me and move forward. So a research into the utility of these multi-joint, versus single-joint movements. So you have 36 train men, all right? Trained. Once we started looking at data and performance, we typically have trained men, sometimes we have untrained if we're looking at basic mechanisms. Muscle strength and body composition, are the two things we wanna know about between single and multi-joint exercises. These are your multi-joint exercises the subjects did. These are their single-joint, right off the bat, you notice whoa, your single-joints can be higher volume, simply because in order to work all the muscles that these do at one time you have to do more single-joint exercises.

So both types, decreased body fat and increased muscle mass and that's good for us to know. When I did say single-joint exercises, are a good starting point for person struggling with weight because their goal is to decrease body fat, increase muscle mass. So we can use the single-joint exercises, effectively for them. We know they have, the single joint has that supporting role but once we move in to athletic performance what we're seeing is the multi-joint are definitely, superior for overall

muscle strength which we wouldn't doubt that if I really wanted to build a significant strength doing a deadlift, is gonna be far superior to doing a bicep curl. And your maximum oxygen uptake, is gonna be significantly higher without large compound, total body exercise. And of course, that's gonna translate to overall performance. The higher the oxygen uptake, typically the better off we are.

So again the single-joint exercises when you go back to your general fitness goals, your concurrent training, when you go back to your persons with obesity and even your active agers. You can use those single-joint exercises and I do so probably, I think they're great for specific goals, just maybe not for athletes, unless you're fixing a specific problem. This is the citation for you if you wanna look at that in more detail. These are just, I threw these out there as ways to think I remember I had a question, initially about unilateral exercises. When you're programming you can get fancy and you can have fun with it. So this is just and again, this is will be something I believe this is, from my book timing resistance training. I might have changed it up a little bit but we do a lot of this in that book where we put routines together and we manipulate different parameters based on, volume, intensity and time and we pair routines a lot which we're gonna talk about in a second, when we pair exercises.

So in this one I just paired two exercises that are similar mechanically, the back squat and the seated knee extension. I kept my reps pretty low 'cause I kept my intensity pretty high 'cause we're talking about athletes here. So moderate to intensity like 45 to 55 or 65% would be an okay in general fitness, probably not gonna be where you wanna be, for experienced exercisers or athletes. As your intensity goes up of course your rest periods go way up. And this four minutes is probably in reality better suited, if this was more like 90. But you can play with it, it just gives you templates. This just gives you ability to play with this, these are examples. So we would do lower body exercises with upper body exercises. Maybe not so much with athletes would we superset those but this might go back to your fitness, your recreational athletes might

use something like this but your real muscle performers, will probably not split it upper and lower. Agonist, antagonist and yeah, especially for hip abduction and adduction where the hip abductors, the rotators have become so significant in roles in inter prevention roles and cycling and running those types of things. The one thing you do wanna say, notice here I'll take this rest break down and the reason I did that between set rest break, is these are not typically super high intensity exercises and normally they're done seated or lying. So your load might be high but I don't know how higher oxygen uptake is gonna get.

So paired training method, lemme get my green arrow. So this is something that is not necessarily new but the way that we use it in my new book is new, only from the perspective of my book is about communicating with recently discovered muscle clocks. And muscle clocks are just internal time pieces that essentially when focused on or towards, when training methods are targeted to communicate best with them, you will get the best outcomes. One of the ways that we speak to muscle clocks to get them on a cycle to get them to turn on the mechanisms we need, for muscle performance outcomes is to use what we call a paired training method which is just essentially biomechanically-similar paired exercises.

So you take two exercises, you pair them based on similar or same joint action and similar or same muscle action. Why? It's a play on volume because one of the biggest dilemmas facing athletics, today is overtraining. 'Cause you think about all this stuff, we do in the strength rooms and then you think, hey, this is only part of the ballgame. Now these athletes are going into sports specific training and beyond that competition. So they're doing a lot. So when we pair exercises mechanically what we're doing is we maximally stress the target muscles, while varying the mechanics enough to change how we work muscles. So again, that's why this is not necessarily a method that's for everyone because we're expected to be seeing these people five days a week. So we have really super, super, highly defined training splits. They will focus on specific

muscles in their performance. So this would be a paired routine for the upper body. The one thing I want you to really pay attention to is once we start getting in athletic training settings, your number of reps goes down because your resistance should really go up. And also where we're combining two fairly intensive, like bench press and push-ups. So those are mechanically very similar so you're not really getting much rest at all for the working musculature.

This just says basically what we've already said is that changing exercise mechanics is typically a paramount or foundation to adding variety or progressing an exercise program. I think I can skip that you guys would know that. So an example of paired exercises if we're gonna, now incorporate plyometric where power is a huge outcome here is your basic push-up with your plyometric drill push-up which of course is going to increase the involvement of those fast twitch muscle fibers. Mixed-intensity Training. Hold on. This is a relatively new take on training. So where volume and overtraining are the huge issues, in athletics to vary your load helps you to lower your volume and I'll show you why.

So this is the study. That's the citation if you wanna go back, you have three different training groups. One at 80%, one at 30% of 1RM and a single set. So they did three sets of 80, three sets of 30 or a single high load which you'll do an 80% initial set and then reduce the weight to 30%. That's your mixed intensity training set, is that last one. And what you're gonna see is that the volume is slightly lower with this last set than with these first two. It's about two thirds, that's the key, about two thirds the volume. The bottom line was the lower volume, mixed-intensity training can simultaneously, increase muscle hypertrophy, strength and endurance when compared to a traditional three set high-intensity, low-intensity training model.

So what that's saying is that if you start out with a higher intensity and progressively drop that throughout the set, you're gonna do less volume or less reps but you're

gonna have the same outcome as if you did a higher volume, high intensity or lower intensity set. And the reason that that's important again is as we try to modulate volume, we have to come up with creative ways to manipulate both time in exercise which is the volume, the absolute volume and the intensity of that volume. So, again, it saves time which is typically not, the athletes necessarily focus but it does reduce that total volume. So Work-rest Ratios. This is where we really get into the most contemporary data where we're now starting to look at our rest between set, I mean excuse me, between reps, so within sets, how are we manipulating our time to get the most out of a muscle? Stacy, I don't exactly understand your question with what is the physiology with this method? I need that, I would need to be rephrased. But I do wanna move on real quick on work-rest periods.

So, research on recovery periods shows that shorter rest intervals within sets, termed intra-set rest periods, are better for muscle strength improvements, than the longer traditional between set rest periods. So this is really important because traditionally, when we were training for muscle performance. You have an allocated number of sets, performed an allocated number of reps with specific rest periods between those sets and those sets had to be done very quickly. That might not be our best bet to get the most out of the muscle. So these intra-set rest periods so think of treating each rep as its own event can range from 10 to 60 seconds. What that does is allow for minimal recovery during the set which we're gonna see what happens.

So, the intent is just to essentially set a number of reps, finish that set even if you gotta reduce that weight. The overall goal of these micro rest as I call them is to coax the muscle to produce greater force, within a shorter period of time which is of course in most speed settings or power settings, that's what you need, so this is important. This should result in greater strength improvements. Saucie I see that follow up with the low-intensity mixed-intensity training. I still don't follow in terms of what exactly the question is. So maybe we can rephrase specifically the whole question. So when we

look at these intra-set rest periods, we're looking, this is what you call, redistributed rest training and it's very contemporary. It's of great interest right now where you divide your rest between each repetition. So in other words, you're really starting to train like power lifters because they'll perform one lift and will be so exorbitantly high in weight that then they'll last for a long period of time. Although our goals typically are not absolute strength as power lifters.

These methods are interesting and when the rest periods are a little shorter so the study which is Tufano, they compared resting in between every set, I mean excuse me, resting in between every rep to cluster sets. Cluster sets are like three, four, two or three up to six so just different smaller denominations of reps. What we wanna know is the effects on muscle speed and strength output and squats. These are a little bit tough. So I'm gonna give you a second with these. You've got three different training groups. Group one, lemme back up. Three different training groups, all the same absolute rest periods but they're broken up differently. So group one they did four cluster sets so you rest for 30 seconds after the fourth, eighth, 16th, 20th, 28th and 30 seconds rep and an additional 120 after the 12th and 24th. I know it's a handful. Group two, they split it up evenly 52.5 seconds, in between every fourth rep. And finally group three gets 12 seconds rest after each rep so you see what they're doing here. We're manipulating time between each rep or each focused contraction, all right?

So what are we gonna get out of this? The key is with the redistributed rest, same rest between each rep. Mean and peak velocity along with mean and peak muscle strength remained, excuse me. I read this one, I need to back up on this one. So start over with me. Number one with redistributed rest over each repetition, mean and peak muscle velocity along with mean and peak muscle strength remained the same. Okay, so that's a good thing. So for redistributed rest, so if you rest between each rep, you get the same remember backing way up, Muscle Force Generation Capacity output, all right? You getting the most boom for each rep there. However they decreased every

four repetition during cluster and RR4 training. So mean and peak muscle velocity and strength decreased when you're forcing the muscle to continue working. So what that tells you is when I do 10 reps at the end of that eight, nine, 10 rep period, I'm getting way less out of the muscle than I did with resting between each rep. So for athletes, that might be a really good way to go.

So the data indicate that when total rest time is redistributed over each rep and in this case 12 seconds, mechanics and speed of each exercise repetition, is more constant improving muscle strength, performance results and that's the bottom line. This would be a time consuming advanced way to train but if you have athletes and I would venture to guess this to go pretty well into physical therapy settings, when you trying to really get muscle performance outcomes, you're trying to improve strength in something that was previously damaged or whatever the case may be in your case that this might be a method that you could use. Volume Saucie appear, so Saucie says what is the ex physiology behind, lower volume mixed intensity training? Can simultaneously increase muscle hypertrophy strength and endurance when compared to traditional three set high-intensity or low-intensity training models?

So in this case where are the volumes lower? What I am guessing is it relates somehow back to this redistributed rest where my volume is lower, I'm able to get more out of the muscle each push. Now the one thing that comes to my attention right off the bat, is I can't remember off the top of my head on that study if well, I guess it was at 80%. You started with and you went down, I'd have to go back and look at exactly how many reps were performed at each particular intensity? But I'm thinking it's a focus on mechanics mechanism. It's a focus on this redistributed rest mechanism where you're able per each rep to get the maximum out of the muscle. That's the study citation on RRT and it's a good one. So sample workout RRT. This is the one thing I want you to pay attention here, right here. Breaks after each repetition, all right? Also look at this advanced lifting, definitely modified Romanian deadlift with a back squat up

to 36 reps, 80% more 1RM. These are not beginning methods. This is definitely a paradigm that's suited for an experienced athlete or recreational lifter. And these rest periods between reps, that's really high. You probably gonna stay down here. This is where your, the 60 seconds is where you're lifting more like a power lifter. All right so one thing, we talked about muscle clocks briefly, your body is on a 24 hour cycle. And you know that, your muscles, each one of them, over 600 of them all have their own muscle clock. And that clock is monitoring 24 hour cycles and looking for cues from you as to when to turn on in anticipation the mechanism associated with muscle performance outcomes.

So one of the things we talked about in my book is that we wanna stay on an 24 hour cycle and when we talk about rest, for advanced strength training paradigms, we wanna stay away from weekends off. And I call that intermittent rest where basically you take non consecutive days off, probably about two, four weeks to stay on that 24 hour cycle 'cause if not, once you get into 48, 72 hours, you're getting into the situation where muscles are like, wow, I thought we were on a 24 hour cycle, now, I don't know exactly what to do 'cause we're going into these longer cycles. Having said that, your recovery period, upper limits, 96 hours, anything beyond 96 hours and you are in the throngs of detraining. Remember this strength gains are negatively impacted by high-intensity cardiovascular training. Why? Muscles get confused. There's a molecular explanation that the mechanisms between cardiovascular, I mean excuse me endurance gains and strength gains are different.

And when you turn those on at the same time within the same short period of time, muscles don't know what to do. They're like, do you want me to get bigger and stronger or do you want me to become or to have greater endurance capacity? The reality, endurance always wins. Endurance takes over. So muscles get confused. This is a key timing parameter. If you can't allow, like if you have an athlete, you can't allow six to 24 hours. The absolute minimum is three to allow, three hours to allow for

mechanisms to really to reset so they don't get confused between modes of training. Optimally six because if they're too close together, this is what happens which is the worst. The mechanisms of strength gains get canceled out by cardiovascular work. Muscle contractility is a big reason why you just, can't have those competing modes of contractility. DOMS, the endocrine events and the microscopic tears associated with DOMS play a roll. Testosterone levels decrease during, cardiovascular endurance training and you need them for muscle growth. Cortisol and blood lactate levels, increase during endurance training but you need them to be lowered for muscle growth, strength and power gains.

So there's a lot of competing mechanisms going on. So jogging is dilemma. Most of us enjoy our cardiovascular, we wanna do it. We enjoy the benefits, we know the problem though, impacts your strength gains. It is widely accepted that jogging is about the worst. So what you wanna do when you're utilizing, cardiovascular training programs in alignment with strength is to avoid muscle confusion. I'm gonna skip these, these are just, okay, lemme back up. Cycling, that's what I wanted to say, cycling is recommended. Running or jogging seems to impede their strength gains more than cycling. Limit cardio and this is again where strength gains, strength goals are number one, all right?

Limit cardiovascular endurance training to 20 to 30 minutes max. You're gonna want to rest muscles for at least 48 hours because it takes after high intensity exercise because it takes that 48 hours for your muscles to return to baseline strength levels. But that can also include an active recovery, like swimming I know that was brought up earlier. That's a great active recovery mode, lower intensity exercises. Schedule your cardiovascular endurance and your strength training on alternate days. Remember concurrent strength training or programming methods are good for general fitness. They're not appropriate where strength outcomes are your primary training goal. Limit your endurance turning into two to three or fewer times per week. Unfortunately, there

is a direct relationship, between the intensity of cardio and strength decrements. So you wanna utilize low to moderate cardiovascular work. This is just a brief sample cardiovascular workout and again, this is appropriate where strength gains are your primary goal and you're not doing concurrent training with general fitness populations. This is our summary, we went over that. So flexibility one of the big issues is okay, this is the bottom line. Muscle stretch is a key stimulus for muscles to grow and get stronger.

However in appropriately timed flexibility training, ends up decreasing muscle performance. Hold on Jamie I'm looking at this. Do they find the same decrease in strength, if one is doing shorter cardiovascular work i.e six minute mile only? Jamie that goes into HIT training which I didn't include here and the shorter the higher intensity modes are better suited to maintaining strength outcomes. I didn't have time here to get into HIT or short burst cardio or short six minute that type of stuff but no you're better off the quicker and shorter duration. Saucie so we can reschedule strength training in the morning and cardio in the evening?

Okay, the most recent data is gonna flip flop that because in terms of timing. Resistance training is best suited in the late afternoon because of muscle pliability and because of some endocrine factors that are working there that maximize muscle strength outcomes around 4 p.m. Cardio is best done, we believe now around late morning and the reason is because that is where muscle tissue appears the best suited to take up oxygen. So flip it and leave six hours. Got that, you guys know this.

The only thing, your optimal length is a joint angle, around 110 degrees for muscle strength that's like a bicep, holding your arm at 90 degree, your elbow at 90 degree and just a little bit beyond that 90 so it's right beyond resting rep. General Fitness, again, our program looks different. One to two static stretches. Hold them or do one to two sets, 20 to 60 seconds each, all right? After a workout. For athletes this is where

we got to be really careful. This is your timing variant that I think is the most important. We know how to go with dynamic before performance, some people like static. If you do that static, so that contractility can return to its baseline, provide five minutes between, stretching bout and performance so the muscle can recover. I give you these flexibility programming references simply because people, there's just a lot there. And I want you to have access to those 'cause I just can't spend a lot of time on it. Sets of exercises we were talking about, are concentric or eccentric? Are you talking about for flexibility training? can you give me an idea of exactly what we're talking about here? Oh, for strength in, that's a really open-ended question. I'm just gonna answer that in terms of sets of extras we were talking about for concentric or eccentric for strength. Usually unless they state otherwise, they're measuring the concentric and focusing on the concentric phase of an exercise. And remember, your eccentrics are good, for your human growth hormone release.

And they're also a good primer for plyometrics. So your wrap-up. Key messages. Neural changes associated with obesity affect motor learning and thus the strength programming that you're going to prescribe. New research suggests plyometric training for active aging. And again, we're gonna get creative with that because of that equipment limitation. Concurrent training is recommended for healthy adults with general fitness goals. It's a great way to train and I don't want you guys to think because once I get into athletics I'm so compartmentalized and it sounds like I'm banging on concurrent training.

I'm not, it's a great way to train, I did most of my life, is just that we know what that interference going on, if strength and power goals and performance are your main outcomes we have to compartmentalize and provide enough of a time buffer. So for athletes our messages are different. Mixed-intensity training helps to modulate our volume, keep it moderate. Use moderate loads where appropriate and high intensity loads where applicable. Manipulate your rest periods within sets, versus between that,

it was all that RRT we talked about. It gets really tedious but it looks like the way to go. Carefully integrate cardiovascular endurance training, in alignment with your strength goals. That's where I was talking about muscle confusion. Timing is so critical. You got that six hour window that kind of thing between strength and cardio and we had the question about cardio in the evening and strength during the morning we flip flop that and we left six hours. Carefully integrate your flexibility work, according to population. Amber, Muscle Force Generation Capacity measures, muscle force output, it measures strength. Does that answer your question?

Are there any other questions that I can answer really quick? These are your references for those studies for those of you who are more into this. As usual, I want to thank you for your time but most importantly, I wanna thank you for your interest, in this content and I hope that sincerely that you're able to take this content and work it into your personal and your professional life. Elena, can we revisit question eight? What is question eight? Joanne, does cardio on alternate days, versus same day change workout? Probably Joanne I'm gonna say yes because you've got a longer recovery time but we'd have to look at the real specifics of that. Okay, thank you, Neoka, I've enjoyed talking to you guys today. I obviously love what I do and it's always an honor to share it with you guys so thank you. on preventing DOMS the only, right now recovery strategies are so in the air, we used to say adequate flexibility, we used to say alternating heat and ice. Some of your ATs and PTs probably know more, than I do on this but probably I would say from a strength training angle, you wanna avoid DOMS, avoid eccentric contractions, focus to centric. Okay those are--

- Thank you so much, Dr. Ashmore, yeah, I found question eight and then we'll wrap after that, thank you.

- [Amy] Okay, what consideration, for concurrent training paradigm design is true? I would say, well, based on if the primary training goal is strength, number D. Now

there's the answer right there, D, yeah. All right Carolyn, I'm gonna turn it over to you. So I'm gonna mute my mic. I am off and I've had a wonderful time, speaking to you guys today.

- [Carolyn] Thank you so much Dr. Ashmore. Thank you to everybody who logged in on this day before a holiday. We're so impressed with your attendance and your great questions and your great comments that really helped us all go a little deeper, into this topic. So we appreciate all of your membership to physicaltherapy.com, we hope to see you in another webinar again soon. Dr. Ashmore, we so very much appreciate your time and expertise, it's wonderful to work with you. We wish everybody a great rest of your day and a great holiday.