

Kessler Institute for Rehabilitation 8th Annual Stroke Conference: Part 3 of 8 Cardiovascular Fitness

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ARIELLE RESNICK: 00:04 When we look at exercise prescription for anybody, it has to be multidimensional. It should encompass aerobic training, muscle strengthening or resistance training, flexibility and posture training, and then specifically for our stroke patients, neuromotor training.

ANNOUNCER: 00:17 Welcome to the eighth annual stroke conference, Breaking Barriers. There's more to getting home than walking. In this podcast, Arielle Resnick of Kessler Institute for Rehabilitation presented The Heart of the Matter: Cardiovascular Fitness and Health Behavior Change for Individuals Post-Stroke. For more information about Ms. Resnick, read her bio in the program notes. This conference was sponsored by Kessler Institute for Rehabilitation and was a one day event that provided participants with an understanding of the multidisciplinary approach to rehabilitation that enables stroke survivors and their families and caregivers to rebuild their lives. Discussion will focus on communication, motivation, spatial neglect, sleep issues, bowel and bladder management, and community integration.

RESNICK: 01:15 I'm Arielle Resnick, I'm one of the physical therapists here working primarily on the neural floor. And what I wanted to talk to you about today is the importance of realizing that stroke is more than just a brain problem. I think a lot of us sort of enter into that mindset in rehab that a stroke obviously is a problem that originated in the brain, but it originated in a blood vessel in the brain. Therefore, it is a cardiovascular issue as well as a neurological issue. So some of the things we're going to talk about today are just providing definitions for health and wellness, fitness, as well as the differences between exercise and physical activity. We're going to talk a lot about the status of health and wellness in both disabled and non disabled adults in the US and worldwide and kind of provide you with some possibly staggering statistics, review models of health behavior change as they pertain to exercise along with barriers and facilitators to change, and then highlight some cardiovascular exercise prescription for individuals specifically post-stroke. So looking at definitions of health and wellness, it is important to realize that they are two different things. And I think a lot of people can define them in very different ways. What I really liked is the World Health Organization's definition of health in 1940. A state of complete physical, mental, and social well being and not merely the absence of disease. So what I think is really important about that is we oftentimes conceptualize health as the absence of disease. But that doesn't necessarily mean that we can't be healthy in spite of disease. And I think that's a really important thing to really drive home to our patients because they're facing a life altering diagnosis, but that doesn't necessarily mean that they're never going to be "healthy" again. And so I think that's something we really have to drive home early on and from the beginning because we are not going to get the kind of buy-in that we need for lifelong change if we don't sort of instill that early on in our patients. And when we look at a definition of wellness, The Guide to Physical Therapist Practice in 2016 said it really well. A state of being that incorporates all facets and dimensions of human existence, including physical health, emotional health, spirituality, and social connectivity. And what I think is really

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interesting about each of those points is stroke in particular, but many other types of diagnoses and disabilities really do target all of those things kind of all at once. And so a person's life really is completely changed from the time that they have some sort of diagnosis or injury. So when we look at something as simple as social connectivity, somebody who now has a communication deficit or a mobility deficit, it can really alter the way that they interact with society, their family, their friends. So it's something that we just kind of need to think about sort of on a multidimensional way that we are-- a lot of us in this room are therapists so we think about the physical end of it a lot, but we don't necessarily think about sort of all of the other implications of that diagnosis.

RESNICK: 03:57

Definition of fitness from the ABTA is a dynamic physical state comprising cardiovascular, pulmonary endurance, muscle strength, power endurance and flexibility, relaxation and body composition with the overall goal of allowing optimal and efficient performance of daily and leisure activities. And really I think the key here is that it's a dynamic physical state. So at any given time, we may be less fit or more fit but that doesn't mean that we can't someday be less fit or more fit again. So again, just thinking about instilling sort of these definitions with your patients and sort of comprising the fact that it is dynamic and it is changing and they have the ability to create that change in themselves. Looking at physical activity versus exercise, you'll see across the two columns that they do share a lot in common. They are both defined as bodily movement via skeletal muscles that results in some sort of energy expenditure ranging from high to low. They are correlated with physical fitness where exercise is very positively correlated with physical fitness. Physical activity not as much. And the primary difference between exercise and physical activity is that exercise is planned, structured, and repetitive body movement. So it is purposeful, it has a goal in mind, and it's meant to be done in a structured way. And its primary objective is to improve or maintain physical fitness components where physical activity doesn't necessarily address fitness but it does enhance the overall health of the person. So now we'll talk about some pretty scary facts. Less than 5% of adults participate in 30 minutes of physical activity every day. That's pretty staggering considering we live in a country that has a significant amount of young people that are also incorporated in that less than 5%. Less than 30 minutes per day puts you in the sedentary category. That's kind of a dangerous place to be. And when we look at physical activity per week, only one in three adults achieve the recommended amount of physical activity each week according to the CDC.

RESNICK: 05:51

When we then take to comparing that in disabled versus non disabled Americans, you'll see that it doubles the lack of-- the amount of inactivity doubles between disabled and non disabled people. So 12.8% of people without a disability are inactive during a given week and it doubles to 25.6% of disabled people are physically inactive in a given week. When we take those outside of the US and look worldwide, this is also pretty staggering. Each year at least 1.9 million people die as a result of physical inactivity. It's considered the fourth leading cause of death worldwide. There are more than 35 people that have died of noncommunicable diseases, which represents 60% of all deaths worldwide. And the definition of a noncommunicable disease is a medical condition or disease that's noninfectious and nontransmissible among

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people. So these are things like hypertension and cancer and stroke, cardiovascular disease and diabetes. So what's the treatment for this? At least 30 minutes of moderate intensity physical activity on five days of the week reduces the risk of several common noncommunicable diseases. So remember now, less than 5% of people in the US are getting that 30 minutes per day. So you can see the trend will be noncommunicable diseases on the rise. So what's really important to consider is 150 minutes a week accumulated in any size bout. It used to be there was a lot of theories that were thrown around that if you couldn't exercise for that 30 minutes at a time, you might as well not exercise at all. It wasn't beneficial. Now they're saying accumulated in any bout. Even if you can only do it for five minutes at a time, that's okay. Just move is the bottom line. Get up out of your chair and move.

RESNICK: 07:27

Again looking at the health of America, at any given time, less than 5% of Americans hit all three of these points. Engaging in 150 minutes of physical activity, consuming a healthy diet and maintaining a healthy body weight, and not smoking. Again, pretty staggering. Only 35 to 44% of adults 75 or older are physically active and 28 to 34% of adults 65 to 74 are physically active. So those are kind of our target populations for people post-stroke. We really need to make sure that we are increasing activity levels just as a preventative measure so before they even get to us, hopefully. And the other thing that I thought is really interesting, 70% of Americans don't get the recommended hours of sleep each night, which is seven and a half hours. How many people got seven and a half hours last night? Six? So a lot of people kind of fall in that like four to five hour range that's awful for all of us. And we're expected to be high functioning individuals, right? So if we're not getting the recommended amount of sleep, 70% of the country not getting that recommended hours of sleep each night and we're expected to be active all the time, how do you have the energy to exercise on top of your full time job? It's awful. There was a statement on the website Move Forward PT that I just thought was really powerful. So physical therapists are experts in physical exercise and can develop individualized physical activity plans for individuals who are overweight or obese to manage weight, prevent the development of obesity or combat its effects. So it's just kind of showing you from a rehab perspective, we are the front line. We have the ability to help prevent some of these noncommunicable diseases from occurring. So maybe you work in an outpatient ortho clinic and you're seeing a patient who's coming to you for osteoarthritis but they also happen to be obese. If we can help increase their physical activity level, maybe we reduce their hypertension and then reduce their risk of stroke.

RESNICK: 09:23

When we look at the state of disability in our country, 26% or one in four adults in the United States have some type of disability. And that's running on a continuum, but ranging from mobility deficits, cognition, being able to live independently or care for themselves, or hearing and vision deficits. And when you look at the health level of people with disabilities compared to people who are non disabled, you'll see the rates of obesity, smoking, heart disease and diabetes are much higher in individuals who have disabilities. And when we compare disability type relative to physical activity, it's not entirely surprising that 57% of people who have a mobility deficit engage in no physical activity in a given week. So that's a really important thing again for us as rehab professionals to really kind of get in on the ground floor and really encourage

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the fact that just because you have a mobility deficit doesn't mean that you can't participate in physical activity or even structured exercise. Adults with disabilities are three times more likely to have heart disease, stroke, diabetes, or cancer than adults without disabilities. And nearly half of all adults with disabilities get no aerobic physical activity at all. What I think is a really interesting fact and it's kind of my favorite thing on this graphic, 82% of adults with disabilities are people who are 82% more likely to be physically active if their doctor recommended it. So sometimes it can be as simple as a primary care physician suggesting physical activity will help a person. The buy in kind of increases exponentially. So that's a really important thing to consider in the way that we interact with other healthcare professionals to really make people understand that yes we are-- as therapists, we are movement experts. We don't have an MD next to our name. Apparently it carries a lot more weight if an MD says, "Hey, you should be physically active." I'm fine with that. Go get another opinion if you don't believe me. But I think that's-- you know, something that we don't stress enough. We kind of operate in a sick care model versus a health care model and so part of what we can do is advocate for our patients to return to their physician. Say, "Hey, my physical therapist told me to be physically active. Do you think this is a good idea?" Apparently what we say is not enough, but if we go that extra step maybe we get somewhere with people.

RESNICK: 11:36

Looking at some stroke specific statistics and this is coming from data from the Framingham study. After age 55, one in five women and one in six men will have a stroke. And really the key contributor to increased stroke risk is having elevated blood pressure greater than 140 over 90. And the lifetime risk of having a stroke decreases by half in both men and women if BP is maintained less than 120 over 80. So it's a pretty powerful thing. Just maintaining blood pressure in an normal range reduces your lifetime risk of stroke by half. However, part of the problem is currently two thirds of cases of hypertension are either undetected or inadequately treated. So there are people walking around who are either diagnosed with hypertension and aren't treating it properly or are undiagnosed because they don't go to the doctor or they feel they can't afford to see a doctor or don't have time to see a doctor. And then after an initial stroke, there's a 13% risk of subsequent stroke within one year and a 25 to 33% risk after five years. So there's a very vulnerable period after an initial stroke that really stretches up to five years post that initial stroke where they are at elevated risk for another stroke. So that's again from a rehab perspective where we kind of come in to work on that secondary prevention. So there's this wonderful call to action by Gail Jensen, who is a physical therapist and an educator. And she said, "Individual therapists in the profession must fully commit to eliminate health disparities, address the social determinants of health, and improve the healthcare, health, and well being of our communities and promote the health of populations." So if that's not inspiring, I don't know what is. I really think we are the people that can force this change in our clients and hopefully eventually they won't need us. Which is a good thing. Looking at some of the literature, emerging trends in health promotion for people with disabilities, what I thought was really interesting is they really kind of honed in on four key areas that look at how we can sort of promote health in our clients and our patients who already have existing disabilities. One of the first things they said was that there needs to be a balance between reactive and anticipatory

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care. And what I think is really interesting is I think as healthcare professionals, we are seeing somebody post something, usually. People don't come to us when they're 100% healthy, typically. So it's easy to fall into a pattern of only reacting to that diagnosis and only providing information or education based on that person's diagnosis. So that's really a reactive healthcare model.

RESNICK: 13:53

We can also really tap into being anticipatory healthcare providers where we're saying, "Okay yes, you had this stroke and now you have this mobility challenge or this cognitive challenge or this communication challenge but here are things that we can do to prevent further disability. So this mobility challenge as you have it now, you have the potential to go back to being independent, but if we want to prevent you from having another stroke that would then increase your dependency again, these are the things that we need to do." Another thing they highlight in this article is that communities need to create enabling environments. We're going to talk a little bit more about this later, but one of the biggest barriers to physical fitness for people with disabilities is the lack of access to fitness facilities, both from a physical perspective and a cognitive and communication perspective. They also state that there needs to be special emphasis on providing support to parents and caregivers of people who have disabilities in order to promote that behavior change in their loved ones because if something-- they're only seeing us for an hour three times a week. What's happening the other 24 hours of that day that they didn't see us? They're with their family, they're with their loved ones who need to also be promoting that change in them. And overall just a call for a paradigm shift where again, we do more that is proactive rather than reactive.

RESNICK: 15:04

This article is also really interesting. It's talking about re-branding exercise and what I think is really interesting about this is they found that people were much more likely to participate in regular exercise if the goals related to that exercise were quality of life based rather than health and fitness based. And why I think that's really important is that health and fitness goals can often seem really distant and abstract. When we think about the typical health and fitness goals, blood pressure reduction of 10mm of mercury or more, better control of blood sugar, feeling less winded when you go up and down the stairs, that doesn't happen tomorrow after you start exercising today. But, if that person now has less back pain today and they can get down on the floor with their grandkids, that's something that they can see every single day. Their quality of life is improved by that physical activity directly. So if we can sort of frame exercise in that way, that it is just going to improve the way that you feel on a day to day basis with the ultimate goal of that change in blood pressure or that better blood glucose control. I think that's another really good way to motivate people. Talking a little bit about health behavior change and this kind of piggybacks off of what Gretchen was talking about earlier, you can use the trans-theoretical model really easily to apply it to exercise and it's being done a lot more now in the literature. There's this great algorithm from Exercise Is Medicine that can really just help you as a clinician figure out what stage of readiness the patient is in so that then you can develop the interventions that are appropriate for them at that given time. So it just kind of runs through, are you regularly physically active? No or yes and it'll lead you to, are they in that pre-contemplation phase, the preparation phase, contemplation phase, etc.?

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RESNICK: 16:41

So when we apply these stages of change to exercise and physical activity, one of the key things here is we have to, above all else, make sure we do no harm. And in saying that, we really just need to meet patients where they are. We have to realize that not all patients conceptualize health and wellness in the same way and so they also-- not only do all patients not conceptualize it in the same way, but they may conceptualize it differently than we do. So it's a really important thing to be aware of. We also have to recognize when there are issues. So if our communication strategies aren't working, we have to change them. And we also have to make sure that we're presenting health and wellness to our patients in a non-threatening way. Making sure that we're not trying to say, "If you don't do this, you're just going to have another stroke." That is not a way to get buy in to exercise. And we also have to really figure out where health and wellness fits into an individual's values. This is really a key thing that is kind of up and coming in the PT world as well as, I think, in healthcare in general, is values based care. So it's not enough to talk about goals, which Gretchen was saying before. Goals are sort of an amorphous and abstract thing for people to understand. But when you talk about what people value, you can sort of get buy in on a different end. So maybe your patient really values being with their family and part of that is taking walks in the park. Helping them understand that your goal is walking but it's so that you can be with your family in the park. It's then sort of enhancing their connection to that activity and why that activity is meaningful for them. So it's really just sort of encouraging us to be more multi-faceted in the way that we interact with patients.

RESNICK: 18:14

Some of the perceived barriers to physical fitness and wellness. Obviously one of the primary ones is access, both from a transportation perspective as well as the fitness center itself. So as many of us are well aware, our patients have mobility challenges and particularly after a stroke they may not be able to drive right away or at all. And they also may not have family members who drive. So having poor access to their community as a result of not being able to drive is a big deal. Even if they feel unconfident getting on a bus, things like that, there's Uber and things like that and you can even call Uber specifically for an accessible vehicle to come and pick you up. But that comes at a cost and it's a cost that a lot of people don't have. And then there's the cost prohibitiveness of just joining a fitness center in general for a person who may be newly unemployed and not able to work. Perceived lack of time is also a big one. Mobility, cognitive and communication impairments, and then any other comorbidities that the person may have. Maybe they have pretty severe osteoarthritis and were on their way towards a knee replacement when they had their stroke. So now they have complex knee pain on top of their mobility challenge that is making them feel like they can't participate in exercise. Jim Rimmer used this tool called the aim free to basically evaluate access to physical fitness in fitness centers. And what I thought was really interesting is that the majority of physical fitness centers scored less than 70% for being accessible in kind of a bunch of different ways. So they looked at access routes and entrance areas. The equipment itself, was it accessible for somebody who had a mobility challenge and was in a wheelchair? Information and signage, locker rooms and showers. I've heard a lot of people, particularly people with spinal cord injury who are primarily wheelchair users, talk about the fact that when they wheel their wheelchairs into the physical fitness

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center, the desk is so high up that nobody even sees them to acknowledge the fact that they're trying to check into the center. So even something as simple as having a cut out that makes you visible from a seated level, things like that. It sort of, just from the very first rolling into that fitness center, makes the person not feel like they belong there.

RESNICK: 20:16

So how do we do this? We have to change the client mindset. So a common thing that you hear from people post-stroke and sort of at the end of their skilled rehab journey is once physical therapy ends, I've hit my maximum recovery potential and I'm not going to continue to get better. We know that that's not true, but how do we convince our patients that this concept of, yes you're being discharged from skilled physical therapy, but that's actually a good thing. That means you're now good enough that you don't need skilled hands on you at all times. You can leave, you can do these things on your own. How do we sort of empower them? So I think it's important when we think about empowering people, we have to look at the barriers that they're considering first. And it's a little bit easier to conceptualize when you look at it based on the ICF model. And if you're not familiar, it basically looks at how an overarching health condition affects people at different ways. So the body structure and function level looks more at impairments like strength, balance, things like that. The activity level looks at their ability to actually complete different activities like walking, wheelchair mobility, things like that. And then at the participation level, how can they interact with society? And each individual person is going to have different things on the environmental factors and personal factors and sort of contribute to whether or not things are barriers or facilitators. So from a barriers perspective at the body structure and function level, we're looking at the symptoms of the condition. So obviously the stroke itself for a lot of people is going to cause weakness. It might cause hypertonicity, joint changes, things overall with positioning, balance. Then we have to look at the length of the time that the person's had that condition. So when they get more chronic, do they have certain mobility changes that are less amenable to change? Are they things that have caused them pain? So maybe for a long time they had a flaccid shoulder that they now have a sublux that is constantly painful for them. And then we also have to look at the presence of secondary conditions. So that's kind of what we talked about before, that person who has severe osteoarthritis and was in need of a knee replacement and then had a stroke after.

RESNICK: 22:08

At the activity level, obviously the primary barrier would be decreased mobility or difficulty just completing their activities of daily living. So thinking about the fact that the person who has trouble dressing themselves, how do they conceptualize-- I need help to get dressed. How can I possibly go out to a physical fitness center and be physically active? And then at the participation level, feeling disappointment or embarrassment in their participation. What is it like for somebody who was an avid gym goer to now have to attend that gym with their cane or in their wheelchair? What does that do to their kind of overall state of being? Other things and other specific impairments. Fluctuating fatigue that's really common after a stroke. People might feel like they just don't have the energy to participate in exercise because they feel like just getting up and doing their morning ADLs takes it all out of them. Lack of walking balance or fear of falling is also a big one. Overall weakness, pain, stiffness,

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bladder and bowel changes are also big. Just it can be a big participation barrier for people that they worry about being incontinent in public. Depression. Thermoregulation may change. Fear of injury, cognitive changes, communication skills, and just an overall apathy that kind of takes over a person when they feel like they can contribute less to society. Some of the environmental factors that's really important to consider is that environment can encompass both a physical and a social environment. So we talked about a little bit before just lack of accessible transport to a physical fitness center is really a big barrier for a lot of people. And then once they get there, how do they access the services inside those facilities? There's often limited suitable or convenient programs that are sort of geared towards people who have a disability. The YMCA has really done a great job over the last five years developing accessible classes that are actually specifically tailored to people with amputations, people with stroke, to really sort of engage people in a way that is meaningful for them and that they are actually meeting a lot of their physical fitness goals. Cost is obviously a big one again. And lack of suitable equipment or training. And then from a social perspective, lack of expectations from others to be active. I think a lot of times, we see it a lot with family members. Oh, you're pushing them way too hard. They shouldn't be pushed that hard. They just had a stroke. And trying to get the buy in from the family that yes they've had a stroke, but they can and should be going back to at least some level of physical activity that's going to be meaningful and helpful for their overall recovery.

RESNICK: 24:26

Insufficient support from facility staff is also big. Most personal trainers have no experience in working with a person with a disability or even how to take a blood pressure so there are fitness associations and you can basically with a Google search find trainers who have advanced certifications in your area, but there are not that many of them and they may not be in a gym that you have access to. So that's just something to consider. Poor social attitude from others. Again, people don't always know how to interact with people that have a disability. So the ability to empower somebody that has a disability kind of takes that special level of education. And then lack of encouragement or knowledge from healthcare professionals. So again, we talked before. It said people are 82% more likely to exercise if a doctor told them to. So again, if your health care professional is not telling you, hey this is important, that buy in is not going to be there. And then on the personal end, increasing age and unemployment, lack of belief or interest in exercise. So a lot of our patients are older and maybe weren't exercising beforehand. So how do we sort of engage them in something that they weren't already doing before because it's going to be that much harder? Again just decreased self efficacy, perceived lack of time and the number of other responsibilities, misunderstanding of what is beneficial exercise. You know, people maybe conceptualize it as only running is exercise. And so they don't understand that no, you can use that recumbent cycle and still get the same benefits from it. And it is still considered exercise. So it's important to look at the facilitators, obviously, since we just talked a lot about the sad barriers about accessible healthcare. At the activity level, we can encourage our patients that this will help them maintain their independence or even regain independence that they may have lost. It can help with their overall function and weight management as well as prevent

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secondary conditions. So things like diabetes if they didn't already have it, hypertension, a second stroke.

RESNICK: 26:19

Personal factors. People get a lot of enjoyment out of setting goals and achieving them when they're the right goals for them. The enjoyment of just the endorphins after exercise and sort of that feeling good right after. It can also promote a feeling of normalcy in our patients who feel like they had all of their normalcy taken away from them. It's just kind of an important way to say like, yes, you're interacting in the community in a way that you could do before and now you can do it again. Motivation and optimism and redefining self and sort of an escapism from everyday boundaries. From an environmental perspective, again, just having accessible facilities and knowledgeable trainers and if you don't have them currently, knowing where you can go to look for them. A lot of outpatient physical therapy programs have aftercare programs where you can utilize the equipment that's in the therapy gym. You're not necessarily under the guidance of a physical therapist but you can maybe feel that's a good place to start because you're in sort of a safe environment. And having sufficient social support, too. So the last section we're going to talk about is actual exercise testing and prescription. I love this cartoon here. So it says, "To prevent a heart attack, take one aspirin every day. Take it out for a run, then take it to the gym, and then take it for a bike ride." So obviously exercise is medicine. The only prescription with unlimited refills. And this really great quote from the American Journal of Cardiology, the editor in 1984, so he asked a question to his readers, is exercise medicine? It has been reported that exercise is an intervention with lipid lowering, anti-hypertensive, positive inotropic, negative chronotropic, vasodilating, diuretic, anorexigenic, weight reducing, cathartic, hypoglycemic, tranquilizing, hypnotic, and antidepressive qualities. Exercise also prevents osteoporosis and 14 types of cancer. So what do you think? Is exercise medicine? Absolutely. And what one pill could you take that does all of that? Nothing. So when we think about exercise in neuro-rehab, why does it get so much more difficult to conceptualize? There's a lot of uncertainty. How often, how much, how long, what type? We may not always feel qualified to prescribe exercise in a way that's meaningful to these patients. We have to, of course, stress the safety and monitoring aspect of it, that heart rate and blood pressure should be monitored throughout exercise. Before, during, and after. And we really need to make sure that we're implementing a more evidence-based approach. So we want to make sure we're doing appropriate levels of screening to ensure safety to even begin aerobic exercise, completing exercise testing and then following that exercise testing, using that data to create an appropriate exercise prescription. And then we also have to keep in mind that there's oftentimes a gap in transitions of care. So the physical state of the person who's discharged from inpatient rehab is different from the physical state of the person who is then discharged from outpatient rehab and then maybe it takes them two months after they've left outpatient rehab to actually start a program. They may be better when they were when they were discharged from outpatient, but they also may be worse. So the prescription that was given to them when they left outpatient rehab may no longer be appropriate for them.

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RESNICK: 29:22

Something that I thought was really interesting. We look at so many people nowadays wear some sort of step counter. And so there was a study done and they actually repeated it a couple times in 2004, 2009, and 2011 and they found that you can classify people just based on the number of steps that they take per day. So less than 5,000 steps a day puts them in the sedentary category. 5,000 to 7,499 low active. 7,500 to 9,999 is somewhat active. Greater than 10,000 is active and greater than 12,500 is highly active. And they found that the average person with a stroke is only taking 4,078 steps per day. So that kind of automatically places them in that sedentary category, which means that they're sort of on the border of low active. They're getting close. But just introducing minimal amounts of structured exercise could push them over the edge to get them into that low active or somewhat active column. Which would then sort of assist in overall secondary prevention. When we look at exercise prescription for anybody, it has to be multi-dimensional. It should encompass aerobic training, muscle strengthening or resistance training, flexibility and posture training, and then specifically for our stroke patients, neuromotor training. When we assess cardio-respiratory fitness, the gold standard is peak exercise testing. How many people have ever done a peak exercise test with a patient? Doesn't happen. And the reason for that is that is that is primarily reserved for academic settings and research labs. You need very specialized equipment. PTs aren't even really all that trained to do it. It's primarily exercise physiologists that learn how to do peak exercise testing. So while that is important and would give us the best information, we should be doing more than what we're doing now. What most of us do is functional testing. Things like a six minute walk or a 10 meter walk to kind of get a baseline for our patient, but that doesn't really give us enough of a picture. So things like sub maximal exercise testing requires very minimal equipment, the protocols are readily available, you can Google sub max exercise testing and come up with the appropriate protocols pretty easily. The most common one right now is the TBRS. Total Body Recumbent Stepper exercise test. All you need is a NuStep that has both arm and leg capabilities and one-- and a NuStep that you can control the wattage of. And there's calculations online that are readily available and that will give you the most accurate data for how to start a program.

RESNICK: 31:48

So when we look at actual utilization of aerobic exercise, overall healthcare professionals under utilize it in neuro rehab. And when it comes to utilization, 88% agree that aerobic exercise is important, but then it drops to 77% that actually prescribe it. So if 88% know that it's important but only 77% actually prescribe it, where is that gap happening? And then even over and above that, most people just wind up using a health record and patient response in determining their program and only 2% actually use an exercise test to guide exercise prescription. So because this information is now more and more available, we should be going that step further. And even in inpatient, we can do a recumbent stepper test and kind of figure out a baseline for a person that could then follow them through outpatient discharge and then into community fitness programs. So what goes into an aerobic exercise prescription? Pretty much for all the domains we want to look at the FITT principle. Frequency, Intensity, Time, and Type. And the type of exercise really should be up to the patient. Depends what they're interested in. If they're only interested in walking, that's completely fine. If they were runners and running is not all that safe right now,

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you can start them on a treadmill, recumbent stepper, upright cycle, whatever it is that they're interested in. The frequency at this point should be three to five days per week but they should also be participating in some sort of activity on most days per week. So we talked about that 150 minutes is kind of the magic number. From an intensity perspective, should be between 40 to 75% of the O₂ peak. But again, since most of us aren't doing peak exercise testing, we really want to look more at heart rate and RPE. So we have to be mindful, obviously, of our patients who are taking beta blockers because they're going to have a blunted heart rate response to exercise. So we do rely a lot more on rating and perceived exertion in those cases. But the general rule for high intensity training, which is becoming more and more recommended even in acute stroke, is keeping it above 50% of their heart rate reserve. And that's age predicted so that Karvonen Formula can be used for that. And then from a time perspective, 20 to 60 minutes per session or multiple 10 minute sessions throughout the day. So kind of making that option available to our patients that if you can't-- if you don't feel like you can do 60 minutes at a time, that's fine. Break it up, 10 minutes, do what you can.

RESNICK: 34:04

From a strength and resistance training perspective, frequency should be a minimum of two non-consecutive days per week. So they can sort of alternate their aerobic exercise days with their strength and resistance training days. Intensity, one set of 8 to 12 reps for healthy adults and 10 to 15 reps for older, frail individuals. The increase in reps for older, frail individuals is because they're going to be using less weight. And a series of 8 to 10 exercises should be performed at each bout. There is an important correlation between strength and ADL performance. So that's something a lot of our older patients who have never lifted weights in their lives or who haven't lifted weights in many years, the buy in isn't always there. They understand like okay, I need to be up and walking but why do I need to lift weights or do any sort of resistance training? So talking to them about how there is a correlation between increased strength and ADL performance is important. Overall, the goal is to improve functional mobility. You can consider training for increasing power and mediating rapid balance responses. So a lot of our patients are worried about things like going out in public and if somebody bumps into them they feel like they're going to fall over. Resistance training and sort of training those power muscles can help with those reactive balance things. For postural muscles we want to primarily focus on muscular endurance and overall just educate our patients that resistance training in general has been shown to help with body composition, glucose levels, insulin sensitivity and things like that.

RESNICK: 35:25

There is a very strong correlation between muscle strength and functional deficits post-CVA. So there was an article that came out in 2006 that looked at strengthening within tasks where possible. So you can use stair climbing as resistance training. ADL upper extremity tasks can also be considered resistance training because they're lifting objects against gravity. One of the keys is avoiding creating muscle imbalances across a joint. It's only, I would say, in the last 10 years that people have agreed that there is no correlation between strength training and increased hypertonicity in patients. So a lot of times people were like, okay well if they have increased tone, why am I going to strengthen their muscles because the tone's going to get worse? More

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and more they're finding that that's not true. You do sort of want to keep in mind that if somebody-- if their upper extremity has increased flexor tone, maybe you focus less on the biceps and more on the triceps but that doesn't mean that you can't do some strengthening activity for the biceps because it is creating that volitional movement versus that involuntary movement. There is no definitive guidance available for unilateral versus bilateral training but I really just think of it as it applies to functional tasks. Most of what we do is by manual in some way. So bilateral training seems to make a lot more sense. These are just some examples of adaptive equipment that people can use to participate in resistance training and aerobic exercise so different grips, ways to sort of attach yourself to the resistance machine if you don't have hand function.

RESNICK: 36:51

Looking at flexibility and posture, the recommendation for frequency is more than two to three days per week of stretching the major muscle groups but there are greater gains if it's done daily. So I usually typically would recommend daily stretching for people. Intensity. You want to stretch to the point of slight discomfort or feeling of tightness in a muscle. This is something that I think is a little bit challenging for patients and their caregivers to understand. What I would venture to say is that most people wind up doing passive range of motion and not actual stretching. They're not taking them into the resistance. We can also instruct caregivers on PNF stretching. And again, timing for these stretches should be 30 to 60 seconds for older people, 10 to 30 seconds for most adults. And two to four repetitions of each stretch is recommended. And from a volume perspective, provide a total of 60 seconds of stretching time per target muscle group for any stretching method that you utilize. We look at things like neuro motor training. This basically encompasses balance and postural control activities that are sort of outside of traditional strength training and aerobic training. So things like tai chi, standing exercise groups, or seated yoga are really good at sort of retraining that mind body connection. You can do things on land or in water. Water is really helpful for engaging postural control muscles without-- you can sort of eliminate that fear of falling. It can work on anticipatory and reactive balance as well as sensory motor agility training and ballistic movements. And these are recommended twice a week. So here's just an example of a multi-dimensional, high cardio-respiratory intensity protocol. So you see the exercise heart rate is-- they're looking at 70% of the heart rate reserve, 30 minutes, five times per week. From a strengthening perspective, it is really important to train the tendon first, particularly if people have significant muscle atrophy. So using those lower weights for kind of a longer period of time than you would expect to need to make sure that you've kind of adequately prepared the tendon for increased load. Again, twice a week, non consecutive days. Flexibility exercises should be incorporated daily and neuro motor once to twice a week. And the key here is all while monitoring heart rate, blood pressure, respiratory rate, oxygen sats and RPE. It's a lot of things to monitor. I wouldn't say that every single person needs to monitor all of this all the time, but I think that's going to be a very case by case basis. Do you have patients who are sort of more vulnerable to blood pressure changes and things like that?

RESNICK: 39:05

When we look at the rationale for exercise in neuro rehab, obviously our primary goal is to improve cardio-respiratory fitness, but one of the other things that we're really

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focusing on is physical deconditioning. So maybe we're just working on bringing them up to their baseline physical fitness where they were before the stroke. They may have gotten extremely deconditioned just in the short time they were in the hospital before they even got to acute rehab and then it's sometimes even hard in acute rehab to get them back up to their baseline. We also know that cardio-respiratory training in neuro rehab can improve other domains of health and wellness as well like depression and anxiety, cognition, sleep, and self efficacy. So overall, we need to design comprehensive programs that reduce the risk for injury during exercise because obviously if a person sustains an injury early on in their exercise journey, the ability to buy in later on is going to be a lot less. We want to help them combat the risk of developing overuse injuries from ADLs, incorporate a warm up that includes dynamic stretching and a prolonged cool down, progressively increase the volume and intensity and also really, really keep in mind that we may not be able to address all four components at once and that's okay. If we can figure out one or two domains that we can focus on at a time and then slowly add the other two domains, that may be a perfectly fine way to go. And then the last thing I want to discuss is just that we can't consider exercise with these patients without also looking at and considering the medications that they're on. Most of our patients have what's considered polypharmacy, which means they're taking more than three medications a day at any given time. So just being aware of what some of the adverse reactions are. Even just side effects that maybe aren't adverse. A lot of our patients who are on beta blockers, I mentioned before, a blunted heart rate response, they may get dizzy when they exercise because their blood pressure is going down instead of up. Same thing with their heart rate. Other things to keep in mind, ACE inhibitors may cause a persistent cough in people which may make them less likely to exercise even though the cough has nothing to do with the activity level. Cardiotonics like [inaudible] so if there is an ongoing history of myocardial ischemia or a history of congestive heart failure that may cause EKG changes at rest and with exercise. So just important to be aware of which is again another reason why exercise testing is so important before we prescribe exercise. Another big one that we don't always consider is transdermal. So if somebody has a nitroglycerin patch or even a nicotine patch, exercise is going to bring more blood flow to the skin, which can then increase the absorption of that medication. So they may get higher doses of the medication in a concentrated time frame, which can cause a lot of issues. Particularly with something like a nitroglycerin patch, which is meant to be a vasodilator. It might significantly drop blood pressure during exercise.

RESNICK: 41:42

Overall precautions to consider. Any cardiovascular precautions that the person had that were either preexisting or new as a result of the stroke. Medications and polypharmacy. What assistive devices they're using and how that may help or hinder their performance. Fall risk and making safe choices. Overall comorbidities and orthopedic issues that were either existing beforehand or exist now as a result of the stroke. So just to wrap up, stroke is more than just a brain issue. We have to encourage a lifelong buy in to physical activity in our patients because we know that physical activity enhances quality of life for all people. And we primarily just have to meet our patients where they are and practice that shared decision making that enables them to feel empowered to exercise and to ask us whatever questions they



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might have. That's it. Oh, I forgot to add at the beginning. I have nothing to disclose. Thank you.

ANNOUNCER: 42:31

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