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Innovative Treatments for Patients Post-Stroke Across the Continuum of Care – Evidence-Based Strategies to Improve Outcomes

Recorded June 20, 2020

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PhysicalTherapy.com Course #3756

- [Calista] Our course title today, is "Innovative Treatments for Patients Post-Stroke Across the Continuum of Care; Evidence-Based Strategies to Improve Outcomes." It is my pleasure, to welcome back, to physicaltherapy.com, Dr. Shannon Compton. Shannon is a physical therapist with extensive experience, in rehabilitation, across the continuum of care, for individuals with stroke and traumatic brain injury. She received her Doctor of Physical Therapy degree, from the University of Oklahoma Health Sciences Center, and she is an American Board Physical Therapy Specialist board-certified clinical specialist, in neurologic physical therapy, as well as a certified brain injury specialist. She currently practices in outpatient, at the Healthy Aging and Neurology Clinic, of Northwest Rehabilitation Associates in Salem, Oregon. Well, thank you for returning to physicaltherapy.com, Dr. Compton, and at this time, I'm gonna turn the microphone on over to you.

- [Dr. Compton] Okay, thank you so much, Calista! I'm very excited to be back, and I'm very excited for everyone that's joining us today. I am so excited to share all of this information with you, and I hope that my passion, for working with individuals post-stroke, helps energize everyone for working with their own patients. In addition to... Oops, let me, I'm sorry, let me get my slide started here. So, in addition to these learning outcomes, and learning objectives, that we're going to go through in just a moment, my goal is for everyone to leave this presentation today, with some new ideas, my patients all know that when I ask them, "Wanna try something a little weird?" The question will, inevitably be followed, by an activity that is fun, relevant to their lives, and maybe just a little bit outside of their comfort zone, but they always leave feeling empowered, that they were able to try something, that they wouldn't have the confidence to do on their own. So, maybe after today, you'll all leave, having something a little weird of your own, that you wanna share with your patients, when

you get back to your clinic. So, in addition to my wacky ideas, we'll cover these four learning objectives today, we'll describe at least five relevant concepts, in motor learning and neural plasticity, to provide a framework for high quality, intense rehabilitation intervention, we'll identify at least three necessary factors, to set your patients up for optimal success in their recovery, both inside and outside the clinic and facility, which as we all know, is becoming very much more important, now that we're a lot of us are shifting to a telehealth setting. We will describe at least two strategies, on how to help the patient identify goals, that are meaningful, realistic, and adequately challenging.

And we'll identify at least three strategies, outlined in the provided patient case examples, that you can apply to your own patient caseloads, across the continuum of care, for both, in person and telehealth therapy applications. So, I wanted to take a moment, just to jump back to the basics, so to speak, about stroke, so that we can remind ourselves, why it is so critically important, that we bring our 'A' game, when we work with these individuals. Stroke is one of the leading causes of disability in our country, incurs huge costs to our medical system, and impacts our economy, since stroke survivors, frequently, are unable to return to work.

On a human level, we know that stroke; profoundly affects the daily lives of our patients, their ability to care for themselves, provide for their families, and engage in their communities. In particular, it appears, in research, that women, have worse recovery from stroke than men, including higher rates of disability and mortality, even when we control for; age, race, education and marital status. Women are less likely to receive TPA, although the research doesn't seem to speculate, as to why that might be. Ultimately, 6.5 million Americans, live with the effects of stroke, and we as therapists, have a huge role to play, in helping them return to their lives. We'll just take a quick look at hospitalization trends, so, what do we know about hospitalization trends? And I'm sure, if you especially work in acute care, or inpatient rehab, you're very aware of

these trends. Acute care hospital stays are getting shorter, so, patients who transitioned to inpatient rehab, or skilled nursing facilities, are transitioning much faster and with greater levels of medical complexity. The typical inpatient rehab stay, is only 14 days, for Medicare patients, and since the patients tend to be more medically fragile, when they arrive, it can be harder to attain the functional gains that are necessary, for them to then return home to the community, after discharge. There is some research to indicate that placement in inpatient rehab, rather than a skilled nursing facility, leads to improved functional outcomes, but this research is kind of complicated, by factors such as age, race and disability severity. So, they found that patients who are discharged from the acute care hospital to skilled, tend to be, more likely, older, female and more physically impaired.

And there are some researchers that have put together a predictive model, to determine, who is most likely to be discharged to a skilled nursing facility, from the acute care hospital. And that tends to be, those with pre-existing physical disabilities, people who are unable to ambulate, at the acute care hospital, and those who are older. They, interestingly, in my opinion, found that, acute care hospital NIH Stroke Scale scores, were not involved in predicting the discharge destination, between skilled nursing facility, or inpatient rehabilitation, so I thought that was kind of interesting. And what do we know about the functional outcomes of individuals with stroke?

So, those who have higher levels of impairment with walking, are less physically active, and are therefore at a greater risk for further stroke. People with higher levels of walking impairment, are also less likely to access the community, therefore leading to greater social isolation, which is a contributor to rates of depression, amongst stroke survivors and their caregivers, and many stroke survivors do not return to work. I really, highly recommend this article, it's called "'Good Outcome' Isn't Good Enough," and if you have not read it, please seek it out. In my personal practice, I've been focused on this problem for years. So, you have this patient come in, and they're doing really well,

technically, according to the outcome measures that you've been using, but they're not getting back into the community. So, how do we get these patients, who are otherwise good, in terms of recovery level, to have enough confidence, to get back to their lives, and what does that take? So, this study was a phone interview, that was conducted with individuals, two to three years, after their stroke, these were individuals, who had been patients at this facility. It looked at 270 patients, with a combination of ischemic and hemorrhagic stroke, and it excluded those who could not speak English, and those who had aphasia.

They used the modified Rankin Scale, the Return to Normal Living Index, the MoCA and the PHQ, as measures of how well someone had recovered, and they found that, 47% of those with a modified Rankin Score of zero to one, which is considered, good, according to this research study, those individuals, 47% of them, had a poor community reintegration, as measured by the Return to Normal Living Index. So, even though these individuals seem like they're doing well in the clinic, they're still not getting back out there.

And I think that as a profession, we sometimes get bogged down in these outcome measures, which don't get me wrong, outcome measures are very necessary, and they're a really good way to be able to say to somebody, "Hey, when you first came in, "and you were first working with me, "you were scoring a 13 out of 30, on the FGA, "and now you're up to a 23 out of 30, "so your balance has significantly improved!" So, that objective feedback can be good for them, but it doesn't really take a look at what's not working, for that individual, and what barriers are still present, for that individual to get back to the community. So, are they playing with their grandkids? Have they gone back to work? Do they feel confident to walk the dog on their own? and if not, why not? And so, I think that, we, as therapists, can really help play a role in problem solving, with our patients, to make sure that they have that confidence to stay active and healthy, throughout their recovery. And I just wanted to pull up, real quick,

this little graph, I put together this pie chart for you guys, with data pulled from the CDC National Health Interview Survey, from 2018. So, they went through and asked individuals, stroke survivors, about their employment status, and about 74% of the people that they surveyed, were unemployed, but had previously been employed. 13% were employed full time, 7%, about, had a part time job, and about 6% had never worked, even before their stroke. So, I think that that's an area that should be of great concern to all of us, and we should be asking ourselves, from the moment that this person enters the rehabilitation system, and we're working on rehabilitative recovery, and getting them back to their lives, how can we set this person up, to be able to go back to work? Because, right now, it's not really occurring at a very high rate.

So, not to make anybody feel gloomy, I just wanna put these statistics out there, and frame this conversation, so that we can be motivated by this. And we do have a couple of tricks up our sleeves, as therapists, to help people achieve these better outcomes. So, we have neuroplasticity on our side, we have motor learning on our side, and we can definitely choose to focus more, on what motivates patients, to get them back to where they need to be.

So, at this point, I'm just going to take a moment, to introduce the three patients that we're going to use as case studies, we'll look at videos of all of these patients shortly, I have a lot of videos, so we'll take quite a bit of time to go through each of the videos, and talk about different aspects of what treatment we're going through in each video, but first, we'll introduce these individuals. So, Mr. A is a 62-year-old male, he is five years post-stroke, with right-sided hemiparesis, and very limited use of his right upper extremity, he has expressive aphasia, and he ambulates independently with no assistive device, but does use a carbon-fiber AFO, on his right lower extremity. He tells me that he's very motivated to be independent at home, so that he can relieve his wife of some of her caregiving duties for him, because there's other family members that live with them, that have their own health issues going on, so his wife is kind of doing

major double-duty, with caregiving for people in the household. So, he wants to be as independent as possible, specifically targeting, being able to get on and off the floor by himself, so that if he were to fall, he would be more confident with that, or, so that he can get on off the floor by himself, to do some of his home exercise program. He also wants to be more confident, walking on uneven surfaces, he lives in kind of a rural community, so he wants to be able to get out, and walk around on his property, without fear, so that he can keep his heart rate up, he can get his exercise in, and also go out and enjoy his property, and enjoy nature.

We'll also talk about Mr. J, he's a 61-year-old male, three years post-stroke, he had an ischemic right MCA, with left sided hemiparesis, he did have kind of, a complication, of his acute course of care, and so they ended up having to do craniectomy for him, and then, he had the skull flap replaced, so for a while, he had his skull flap out. He ambulates, currently, with a small-base quad cane, and a left-hinged AFO, we recently graduated him from a KAFO, and I can talk a little bit about that, if anybody has questions about, kind of progressing someone out of certain orthotic devices, if you guys wanna talk about that, he's standby assistance for household distances.

And, his current motivators, he wants to require less help from a paid caregiver, 'cause his wife works during the day, so, they pay for someone to come into the home, and he also wants to return to some form of work, so that he can feel, quote, "Useful again." And he's said that, he'd be open to doing a volunteer position, he really would like to go back to some kind of part-time work, at the company he used to work for, but we're kind of working through some of those aspects, right now. He specifically wants to be independent with in-home ambulation, and to no longer use his wheelchair in the community. And the third individual we'll talk about today, is Mr. K. So, he's a 54-year-old male, one year post-stroke, he had a thalamic hemorrhage with right-sided weakness, he also has expressive aphasia, he has some really good returning upper extremity function; which I think you'll get a chance to see, in a couple of the videos,

and he ambulates independently, without an assistive device or an orthotic. When he came to me, he was in a wheelchair, using a cane, and using an orthotic, and so, we've been able to progress him away from those things. And his current motivators, he really wants to go back to work, so that he can relieve some of the financial strain, on his wife, he owns his own company, so he wants to be able to get back into it, since he spent years, building this company from the ground up, And he is specifically targeting some higher-level dual task and agility task, so, because he works in a very busy, kind of manufacturing type environment. So, we're trying to do a lot of cognitive dual tasking, with an upper extremity motor task while he's moving, so that we can kind of simulate him, getting back to the floor, at his work environment.

So, those are the three gentlemen that we'll talk about, and I do currently, I'm sure you can tell, based on the chronicity of the stroke in these individuals, I work in outpatient rehab, currently, but I have worked a little bit of everywhere is what I say. So, the only setting I have not ever worked in, is the acute care hospital, but I've done inpatient rehab, I've done skilled nursing, I've done home health. I've done outpatient, I've done, like a community day rehab program, for individuals with stroke. So, I think, I feel like I should be able to speak to a lot of the different struggles, that you guys have, in different settings, depending on where you're at, and then we'll talk a little bit about telehealth too, since that's changing right now.

So, what is the biological basis for change, with neuroplasticity? So, as we know, neuroplasticity is the brain's capacity to remodel, both structurally and functionally, in response to new stimuli and experiences. And what do we know about stroke, in regards to the brain? Well, we know that it causes direct and indirect disruption of neural networks, we know that when someone has a stroke, it activates a strong immune response, so you get a flood of inflammatory cytokines, and activity of the microglia, which are the supporting cells in the brain, that are sort of like the cleanup crew, and you also get changes in dopamine metabolism. So, they've done animal

model studies, where they will take a mouse or a rat, and they will give them a middle cerebral artery occlusion, so it'll give them an ischemic stroke, and they find that those little guys, end up having an initial massive release of dopamine, and a subsequent dopamine scarcity in their brain, after that initial flood of dopamine coming out. So, they're doing some research into dopamine supplementation, in the animal models, and there is also a research study called DARS, D-A-R-S, dopamine... Well, I forgot what that acronym stands for, I was just reading this article actually recently, but they're starting to do some dopamine supplementation research in humans as well, to see if pairing dopamine supplementation with rehab, after a stroke, in human individuals, helps improve neuroplasticity and recovery.

So, there are several proteins and different factors, in the brain that helped promote neural plasticity, we have brain-derived neurotrophic factor, insulin-like growth factor 1, vascular endothelial growth factor, neuropeptide Orexin-A, and those tend to be in these research studies, the molecules and the factors, that they look for, when they do blood draws, to see how those are changing with different interventions. And then we have different detractors, so, microglia, which again, are those, kind of cleanup-crew cells, in the brain, interleukin-6, interleukin-8, C-reactive protein, and tumor necrosis factor.

So, whenever we have diseases of the brain, whether it be stroke, or something like; Alzheimer's, Parkinson's, or even MS, that what happens, is that, the microglia and inflammatory proteins, kind of run rampant, and create this overall state in the brain, that's harmful for the development of new neurons, and the regrowth of neurons. So, we want to try to tip the scales, back towards increased BDNF, increased insulin-like growth factor-1, increased vascular endothelial growth factor, increased neuropeptide Orexin-A, and so, what can we do to tip the scales? As physical therapists, there are many things that we can do, there's much research out there, right now, about, especially the effects of intense aerobic exercise, and the improvement of

brain-derived neurotrophic factor, and these factors that improve neuroplasticity. So, we can increase BDNF, we can increase cerebral perfusion, we can increase dopamine levels, and we can help decrease the inflammatory cytokines. And so, in addition to things like aerobic activity, we'll talk a little bit about some specific motor learning styles, and motor learning techniques, that we can target. So, one thing that I think is particularly interesting, and that I did not know a lot about, when I was going through physical therapy school, is called motor priming, and this is kind of a fancy way, of saying that you're just getting the brain ready to learn.

So, motor priming involves a type of implicit learning, wherein a stimulus prompts a change in behavior. So, priming can increase cortical excitability, increase the production of neuroplasticity, enhancing neurotrophic factors, like BDNF, and increase the brain's readiness for motor learning. And the authors of this article, talk about five categories of motor priming, so, we do a lot of these things, but we don't necessarily, I think, always call it motor priming. but I think a lot of us, naturally, do these things in our practice, without necessarily realizing so. So, you can do stimulation-based priming, which involves NMES, typically, they'll also talk a little bit about transcranial magnetic stimulation, as a version of stimulation-based priming.

But, I think a lot of us, especially in inpatient rehab, will try to use things like; NMES, or a Bioness, or some kind of device like that, to try to get electrical stimulation-based priming. Motor imagery and action observations, so, trying to have somebody picture what they're doing, trying to have somebody watch you do the tasks, so, I know that I do this a lot, when I'm trying to get somebody to do a sit-to-stand, for example. So, I'll go over and get a chair, and I'll demonstrate the sit-to-stand, and they get to watch me do the motor task, and then, they get to then practice the motor task. We can do a sensory priming, and sensory priming can involve many different things, but you can work on trying to have someone pay more attention to the affected limb, whether it's through tactile cueing, haptic feedback, those kinds of things. So, sometimes you'll

have people kind of like tap the, if you're trying to get someone to stand taller, or really, activate their quad, during stance phase of gait, and they're needing a little bit of facilitation, you can kind of like tap the quad, and say, like, "Make yourself taller, make yourself taller!" And try to get that muscle to activate a little bit more, and get the brain a little more in tune with that area. Movement-based priming, so you can have someone practice a movement, before they go into gait training, for example, or movement-based priming could even be, having someone warm up on the bike for 10 minutes, so that, they're getting their aerobic exercise capacity going, and they're getting that brain production of neurotrophic factors, and things that are important for neuroplasticity.

You can also do pharmacological priming, which we've talked a little bit about, with dopamine supplementation, there's also research to show that, particularly, in individuals with post-stroke depression, that supplementation with SSRIs, can help improve motor learning. So, we'll now move on, to talk a little bit about some of the principles of neuro rehabilitation, and these concepts were pulled from an article by Maier, from 2019, and a lot of these concepts look familiar to most of us, probably, because, they're things that are commonly talked about, in physical therapy curricula.

So, talking about how we structure our practice, so how do we time the practice, are we doing massed practice or repetitive practice of a task, are we spacing out the practice of that task? And what is the dosage, or duration, of the task that we're practicing? We know we can set up our treatment sessions, to change the focus, or the target, that we're focusing on, so we can do task-specific practice, we can vary the practice, we can increase the difficulty of the task. Some of these overlap a little bit, with the neuro-priming slide that we talked about. So, we can change the modality of some of our interventions, we can do multi-sensory stimulation, by having some kind of help haptic-feedback vibratory sense, we can do rhythmic cueing through auditory feedback, whether it be through music, whether it be through a metronome, we can do

motor imagery or mental practice, we can do an action observation, or embodied practice, and we can do social interaction. We can also alter different aspects of the patient's focus and feedback, so we can give them explicit feedback, knowledge of their results, so how did they do in achieving the results of the task? We can give them implicit feedback, so, talking about, how did they perform on the task? And we can also modulate effector selection. So, these are kind of the different things, that we have all learned about previously, and principles that I think a lot of us are familiar with. But that brings me to the "10 principles of Experience-Dependent Plasticity," which, this article is from Kleim and Jones, from 2008. So, these principles are; use it or lose it, use it and improve it, specificity matters, repetition matters, intensity matters, time matters, salience of the task to the individual matters, the age of the individual matters, and you can also have transference of motor learning of a task, or interference of motor learning of a task.

So, transference is where, if someone learns to do a certain task, say a sit-to-stand, it will also then transfer over to their ability to, or say they're doing a sit-to-stand, to get out of a chair, it would also then transfer over to their ability to get out of bed, or get out of a car. Interference would be, where learning a certain motor task, then interferes with their ability to do a different motor task, and the best example I have for this, is the example where a lot of baseball players, really have difficulty transitioning to tennis, because the swinging of a baseball bat is different enough, but yet similar enough to swing a tennis racket, that it kind of screws up your forehand, if any of you play tennis, you know what I'm talking about. And, I don't wanna get into, like, wade into the weeds too much on any of these principles, 'cause I'll sum them up, and kind of wrap it up in a neat little bow, for you guys at the end, and we can also, when we go through each of the videos, we're gonna talk about how some of these specific theories, apply to these specific patients. So, I wanna take a moment to talk about, the "OPTIMAL Theory of Motor Learning," and if you listen to my last webinar, you'll know that I'm a big fan of this theory. So, it states that, "Motor learning is best promoted "through;

enhanced expectancies, learner autonomy, "and an external focus of attention." And, I would argue that, where the OPTIMAL theory of motor learning, really succeeds, is that, these other frameworks, don't really focus very much, on the motivation of the person to learn, and I think that's a really key, key point. So, let's talk a little bit about salience, or making sure that the task is specific, but if the person is not motivated to learn, and if the person is unable to really see how that specific task, or if a therapy intervention, that you're working on, pertains to what they wanna do, it's gonna be more difficult for them to get involved.

So, how does the OPTIMAL theory affect the brain? Well, it increases dopamine production, it improves long-term potentiation, so greater neural connectivity, it really gets co-activation of certain neural networks going, so, the neurons that fire together, wire together, so, the more that we can get the correct neural networks firing, for say, walking, the better. And you also are going to get improved activation of neural networks involved in task-related functions, and motor learning, so, it actually fires up the parts of the brain, that are involved in motor learning and making that happen. And what is the importance of motivation?

So, we can set people up for success, in every way, for motor learning, but if they're not motivated to participate, their recovery is going to be very limited, and what we do in therapy, can sometimes be repetitive, as we know, or kind of abstract, So, "Reach for this cone," everything is with cones, why we love cones so much, I don't know! I find it hard to get away from cones too, in my practice, because they're just so easy to have around, but that can be very abstract for a patient, because they've never used a cone in their life, until they got to therapy. So, those kind of abstract things like, "reach for this cone, or step up on this box," so we just need to make sure that we're tying each therapy very explicitly, back to the patient's motivation. And I love this quote, from the "OPTIMAL Theory of Motor Learning" article, which is that expectations are not motivationally neutral. So, we need to make sure that, not only are we playing to

the patient's motivation, and that we're adjusting our interventions for that, but we need to make sure that the patients feel, that these interventions are attainable. Because, if you think you're going to fail at something, what motivation do you then have, to attempt it? And so, I know at the beginning, I had mentioned that, when I work with my patients, I usually try to have them do something every session, that's just a little bit outside their comfort zone. And so, that's an area where you can really, really use your clinical judgment, and really get creative with things, because you need to dial into what each individual person is feeling, and how each individual person relates to the tasks that you're doing, to make sure that what you're asking them to participate in, is just a little bit harder, than what they would ask themselves to do. And I think, I, as a therapist, watching other therapists' work, I think that part of what I do differently, is that... I'm sorry, I got a little distracted here!

Part of what I do differently, is that, I know, and I have confidence, that whatever I'm asking the person to do is safe, but it's a little bit different, than what they're going to get at a different facility. So, what is a good example of this? Well, we'll get to the videos and you'll see, so, it's really about your confidence as a practitioner, and making sure that, you are really asking your patients to step up to a higher level, and knowing that, you have the confidence to pull it off, and keep them safe at the same time. So, let's put it all together, what are those salient points, that we can pull out from all of this motor-learning and neuroplasticity research?

So, motivation matters, how the person feel matters very much. Keeping the focus external, so trying to keep the patient focused on some kind of external target, so rather than saying to the person, "Let's straighten your knee," trying to give them some kind of external target to shoot for. So, I like to say to people to try to get taller, that's a good cue for them, and when you try to ask people to get taller, they usually, automatically will get, better knee extension. Feedback is also key, so, making sure, that people are getting the right type of feedback, making sure that you're timing your

feedback in a key way, and this is something where, in the OPTIMAL motor-learning article, they really talk about involving the patient, and asking them what kind of feedback, they would like to receive. So, I'm asking them, "Do you want me to tell you each time "you do a really good job, do you want me to tell you, "at the end, how you're doing?" Because the more you give the person some kind of control over their session, the more involved they're going to be, and actually, the more cortical excitability that they're going to have, because then they're going to be more engaged in the task. So, we know, from motor-learning research, that people do tend to do better, with summary feedback, motor learning is going to occur more with summary feedback, versus feedback after each trial, and we also know that people tend to do better, with feedback, after good trials.

So, something that I like to do when I give people feedback, is when they're first learning, first doing the task, practicing something new, I'm gonna give them that feedback a little more frequently, maybe after every second or third trial, especially when I see something good happen, and I'm always very upbeat. So, even if it's not a perfect trial, I try to highlight the good things, but something I also like to do with people, is I like to have them give themselves feedback. So, I really ask them, "Okay, break it down for me, "what did you do well on that, what worked well for you, "what went the way that you wanted it to?" And that, then gets the person, to really reflect on their own performance, and try to put the connections together, of, "how can I recreate this later on?" And that's something that we can definitely do, across all settings, is really trying to make sure that, even in an acute care setting, where you're first getting someone mobilized, first getting someone up out of bed, or in the inpatient rehab setting, where we can a lot of times, be so focused on FEM scores, and trying to make sure that people are getting to a certain level of independence, on the FEM score, before they leave. But really, engaging them and making sure, like, "Okay, yeah, we're gonna practice a lot "of bed-to-chair transfers, because at the end of the day, "you really need to be able to have "some kind of independence with a bed-chair-transfer,

"in order to go home safely." But having them, really reflect on, and say, "Okay, what did I do right that time? "How was the chair setup, did I do this, did I do that, "and that, kind of feedback, and self-reflection, "can help them really make those connections, "and make things stick." So, we also know that volume matters, and this is something where, again, going back to the fact that people are leaving the acute care hospital, earlier, and getting to a skilled nursing, and inpatient rehab facilities, sooner, with more medical complexity, this can make things a little bit challenging, as far as volume goes. And I know in particular, when I worked in inpatient rehab, it's really hard to get people out of bed all the time. Sometimes that three hours a day of therapy can be very challenging for them, because if they're getting speech, OT, and PT, and they're not getting enough rest in between, it's really hard for them to be alert, awake, engaged, their endurance is really low, they're really de-conditioned, so, trying to get the volume that we can, when we can.

And so, since we know volume is really important, trying to really, partner with nursing staff, partner with the family, to make sure that what we're doing with these patients when they're not in therapy, is really keeping them engaged, and trying to get smaller doses of activity, spread throughout the day, so that they are getting enough volume of repetition, of whatever the task is.

And that's something where, depending on how things are at your facility, it might be good to try to work on partnerships, between rehab and nursing, to try to do some education there, and make sure that, depending on what strategies each patient is using for transfers, or sit-to-stand, or whatever it is that they're getting those carry-overs to nursing, and that patients aren't just sort of being taught a different transfer strategy with nursing, and they're not getting the repetitions that they need, to be successful, with what we're trying to teach them in therapy. So, the volume matters, but so does the quality of what we're asking them to do, and so, this to me, is very important with a lot of my people, because I almost have to, like, rein them in, and get

them to really slow down, on some of the activities that we do, because they just wanna, these guys, especially the ones that were gonna watch the videos of, today, they wanna go, go, go, go, but their quality, of their gait mechanics, or their movement mechanics, tends to break down because they're having fatigue, these guys are all fairly chronic, in the chronic phase, after a stroke. There's a lot of secondary impairments that they have, in regards to weakness of their affected limb, and so, especially their leg, their affected leg, typically, can't keep up with the strong leg, and so, rather than letting that strong leg just continue to do everything, and let their biomechanics deteriorate, even though they wanna go, go go, I tell them, "We need to take a break, you need to sit down, "let's let that leg recover, "and then we're gonna come back and try it again."

And also, I think, that intensity is not just about the cardiovascular load that we put on our patients, is it important to make sure, that our patients are getting an aerobic capacity, stimulated to a certain extent, that we're getting their heart rate up, to 60% to 80% of heart-rate max? Yes, all of that is very important! But, I think that we can make tasks very intense for people, and get their heart rate up, without just making sure that they're, "go on, go, go, go!" on the bike, or we're gonna get you on the treadmill, and it's going to be, "Walk, walk, walk, walk, "walk at this certain pace."

There's ways to increase the intensity of the task, and the demand on the person, by increasing also, the complexity of the task, and we'll see that on some of the videos. And it is very challenging for the person, but it's also then going to be quite a bit more beneficial, for the person, for a return-to-life kind of scenarios, versus simply walking on a treadmill in a harness, or something like that. And we can also prime the brain for learning, so, we can make sure that the person is doing some kind of movement warm-up, to make sure that, not only are their muscles and tendons ready to do work, but also make sure that their brain is ready to learn. We can give them different kinds of haptic feedback, auditory feedback, to help prime for learning, we can give them some

sensory input to prime for learning, and we can talk a little bit today, in one of the videos, about some sensory reweighting strategies, that we use at our clinic, and so, we'll talk a little bit about what sensory reweighting means, but we won't wade too deep into the weeds on that either. So, let's talk about the outline for the next section, I'm gonna review a case study, we'll focus on an activity related to the patients' goals, so we'll go through videos, and we'll probably watch each of these videos several times, to highlight different things.

We'll review how each video relates to relevant motor-learning principles, and then we'll discuss how to modify each activity, for different settings, and for telehealth, and I think when we get into the videos, you'll see what I was trying to convey earlier, about the kind of confidence that I have, in what I'm asking the people to do, is very different, than what you might necessarily feel confident, asking your patients to do, at your own clinic. But I think once you see what these people are doing, and how they're performing with it, I hope that it gives you some more confidence, to try some kind of, quote, "wacky things," with your own patients, and to know that, a lot of these individuals, after a stroke, are able to do and perform, at a level that we may not realize that they are able to.

So, hopefully, it gives you some confidence to ask just a little bit more of your patients, if you feel like you've been kind of holding back, a little bit with them, or playing it a little bit safe, or taking it a little bit easy with them. Okay, so we're gonna, again, just review, real quick, Mr. A. So, his current motivators were that, he wants to be more independent at home, and to relieve his wife of, some of the caregiving stress for him, because he has another family member at home, that has some major health issues, and we were specifically, targeting independence with fall recovery, which unfortunately, I don't have a video of, but, for the videos that we need to have today, we're gonna look at confidence for walking on uneven surfaces, so he can perform a more intense home program without fear. So, my plan is to train him to do something

even harder, than walking on uneven surfaces, so, jumping, so that walking seems more simple to him, and then also working on walking under different conditions, to improve control of his right lower extremity, because this gentleman, if you recall, has right hemiparesis, he also, generally walks without an assistive device, but he does use an AFO on his right lower extremity. So, Kathleen, I will have you pull up the first video, thank you! Okay, so here we have a video of him jumping, this is the first time we tried jumping on an agility ladder and so he's just trying to do a two-feet-in, two-feet-out pattern.

And you can see I'm walking next to him, I'm guarding him, and making sure that he isn't going to lose his balance, but he's pretty steady here, and you can note that he has some difficulty with jumping, his right leg, you can see there, trying to get it outside the bounds of the agility ladder, equal to his left leg. So, hip abduction is definitely a challenge for him there, not getting a lot of knee flexion when he's trying to jump, definitely somewhat limited at that ankle, due to spasticity, and then also, his brace doesn't really allow for a lot of plantar flexion, so that is somewhat limiting his range of motion there.

And if anybody has any questions, feel free to type them into the chat box, as we go through these videos. So, you can also see he's pretty sweaty, so he's working really hard, during this task, so we're definitely getting his heart rate up. And you can see he's working really hard, and the foot placement on that right side, is really challenging for him to get it squarely in the box, to not just land on the yellow. So, we'll go to the second video now. So, how do we get him to improve this? So, I decided that I was gonna have him walk up and down the agility ladder, and just focus on getting better hip-abduction activation, at that right leg. So, right now, we're working on movement motor priming, so, trying to get him to be able to place his leg a little bit wider outside the box, so that he knows that it as possible, and then his brain knows that it's possible, and I'm giving him these little cups to kick, and we'll back up a little bit here.

So, the reason why he's kicking these cups, is because it's giving him something external to focus on, so, rather than saying, like, "I want you to jump your feet outside the box, "and then inside the box," I'm just having him kick the cup with his right foot. And I have a question, "Did you think about changing his AFO, "to have more dynamic motion?" Yes, so, we're in the process of that, right now, his orthotist was not happy with me, for how much work I make him do in this orthotic, he was like, "This brace is not designed for jumping, "or running ,or anything you have this guy do."

So, we actually, and I'm not trying to promote any certain product at all, but I did have Bioness come out, and do an evaluation for him, because he responded really well to NMES, and his gait pattern, when he has NMES applied to dorsal flexors and hamstrings, vastly improves his gait mechanics, and so, I went ahead and looked into a device, that would allow him to have that stimulation applied automatically, during gait. And so, we're kind of in the process of waiting for him to have that product delivered, so that we can get away from using the brace completely, and then he will just have an NMES, or functional E-stim device for walking. That's a great question!

So, we'll go to the third video now. Okay, and in this video, so we go back to jumping, but I'm having him jump and hit the cups. So, once again, I'm not having to worry at all, about where his foot is going, or giving him any kind of internal cues about, like, thinking about his body position, the only cue I gave him was, "Okay, you're gonna jump, "and you're going to kick the cup as you jump, "and then you'll jump and bring your feet back together." And so, you can see he's doing a lot better, he's actually doing a really good job, of, from this view you can see, really trying to get some better hip and knee flexion, to load that right extremity before he jumps, so he's automatically getting more power out of his jump. And having the cup there, is having him very successfully, be able to get his foot outside the box each time, and there you can see, he didn't quite hit the cup, but then he went back and did it again. And so, now, we'll look at the fourth video. Let's see here, so this is now, without the cups, so this is our

post-training video, and this was all within one session. So, this was about a 10-minute span of time, that we worked on these things, so, we've taken the cups away, and you can see that he is more consistently, getting his foot outside the box, on the right-hand side, you can see that he's getting more hip and knee flexion, and I apologize for how much of the video I had, cut off, but I was trying to film, without getting someone else's face, in the background. So, you can just see how much improvement he had, from the first time, to this time, with this task, and he felt really good about this task, especially, because he no longer needed me standing next to him, so, just within one session he progressed from a standby assist, to just being independent, with this hopping task, and you can see there, he even had a little like, 'oops' moment, and he got the rung of the agility ladder there, stuck between his feet, but he was able to correct, he had good balance reactions to anticipate that, and pause, and sturdy himself, and then, you're not able to see it but the video continues, and he is able to get his feet repositioned, that he's not caught on that rung anymore, and he's then able to continue hopping.

And we'll just take one more video peek, so I think we have one more video for him. Okay, so this is the same individual on the treadmill, and I have him walking backwards, up an incline. So, we're actually running our treadmill, you can't really tell that it's inclined, very much in this video, I think it's maybe only a one or 2% incline, but we are running our treadmill forward, so, he's facing backwards, he is in a safety harness on this. And we're trying to work on getting him to get a little bit better knee flexion, a little bit better hamstring activation, and you can see that he's having some trouble with it here, not quite getting as much hamstring activation as we would like, but that's okay, because it's a process of trying to get better motor control for people, so I wanted to show you guys this video, to show an example of something that I do, where this guy isn't necessarily doing it perfectly, he's not necessarily getting great hamstring activation, with this retro walking. But, I think it's important to work on this, because something that you'll note, is, let me back it up a little bit here, so, he is clearing his foot each time. Now, he is hip hiking a little bit and you can't quite tell,

because his hip's out of you, so, he's doing a little bit of hip hiking, to get that movement, but that's something that we've worked on quite a bit, with NMES, and functional E-stim, as well, while he's on the treadmill, just to try to get better hamstring activation, going in reverse. And something you'll see a lot of, with people after a stroke, is that, you'll ask them to walk backwards, and they'll just drag that foot, that affected side, because they have just no hamstring activation, of which to speak. So, something that I work with my patients a lot with, on the treadmill, is just trying to have them work on getting that foot clearance, up a little bit more, and with the cue that I give them, typically, is to say, "Let me have you not let your shoe drag!"

And so, that's an external cue, focusing on the shoe, and focusing on not letting it drag on the treadmill, and typically, that is enough to get the person to get, you'll see them, almost immediately, get a little bit more knee bend, especially if they have some hamstring activation there. And then, if you have them doing some hip hiking, you can work on some different strategies to try to get them to keep their hips level, and so, not hiking. So, one thing that I have done in the past, if people are hip hiking, which our treadmill, if the person is backwards on it, they're actually facing a mirror on the wall, and so, something that I'll do is, I will put sticky notes on their ASIS, on their hip, so, that bony point there, and I'll have them watch the sticky note in the mirror, and if it is excessively going up and up, you usually have to like tape it to their shirt, or something, but then they can watch the movement of the sticky notes, and that gives them the cue.

So, you say like, "Keep the sticky notes level, "and don't let your shoe drag." And then, those two constraints usually get them to a point, where they're getting a lot better hamstring activation. And I have a question that I'll read, "In regard to the agility ladder task, "was he, and were you confident enough, "to give him something for his HEP, "to allow for increased volume?" Yes, so, that is something that I did give him, to work on at home, but I gave him the instruction to, at home, try it next to his kitchen counter,

and that's something that I do a lot of, for my patients, because he's really good with his left hand, with his reactions to grab something, if he is starting to fall. So, I felt comfortable with letting him practice that, at home next to a kitchen counter, or next to a table, to where, if he started to lose his balance he could grab, and then, that would be something where, once we've practiced it more in the clinic, and I get to a point where it's like, "He's got pretty good writing reactions, "and I'm really not worried about him falling." I would have him try it at home, move a little bit further away from the table, or the kitchen counter, so that he doesn't have that upper extremity support, there, available for him.

Okay, so if you don't mind, Kathleen, flipping back to the PowerPoint, and it'll just take a moment to load. Okay, so we'll talk about, the "Relevant Motor Learning Principles," that we looked at here, so for motivation, this patient wants to be able to have a high level of independence with his mobility, so that he isn't so reliant on his wife for safety, and for support. So, I just explained, and I do this with all of my patients, I just very explicitly tell them how a task such as hopping, relates to their balance reactions, their motor control, and overall, their confidence, and I think, just telling this individual, "Well, if you could hop, you can definitely walk outside, "on an uneven surface and have more confidence with that." He really bought in to that, and he was all about hopping, we also, I don't have a video of this, but we also work on jump-rope with him.

And he's not somebody who's gonna go out and do jump rope, or join a Double-Dutch competition, or anything like that, but he knows that, if he's able to get the timing of jump rope, down, and to have the motor control, to be able to move his leg when he wants to, as fast as he wants to, he knows that he will then, also have the kind of stepping reaction, or balance reaction, necessary, to prevent a fall. And so, I've really done a lot of work with him, to talk about how these, seemingly strange activities, that he is not necessarily going to do at home, relates to his ultimate goals. So, also keeping the focus external, so, I talked about, rather than focusing on increasing the

size of his hops, or saying "Get your foot out there a little wider," I just gave him a cup to hit with his foot, and he immediately was able to get better hip abduction, with that movement. So, for feedback, for type and timing, we did summary feedback after his good trials, and I also let him watch video replays, I do take a fair amount of video of my patients, just so that they can then watch and see, and I think that's a really powerful tool. Also, if you have videos over time, to say, "Well, this was three months ago, and this was today, "and this is how you've improved in that time!" In my case, I see people for that long, but even if you are able to say this was two days ago, and this is today, in more of an acute or an inpatient setting, I think that's really powerful for people as well. So, volume matters, we practiced quite a lot, over the course of one session, and so, really, we focus quite a bit of our session on this task, so, we did a lot of volume, and then, also quality matters.

So, again, I made sure that he did took a break, when the quality of his movement deteriorated, and he's a person that I have to tell all the time, "No, you need to sit down, you need to take a break, "grab some water, take a rest!" Because otherwise, he would just keep hopping, and hopping, and hopping, until his leg gave out on him a little bit. So, that's something too, that you have to consider, in terms of home program, is, if you have somebody that is going to push themselves a little bit more, you might have to be a little bit more explicit with them, about making sure that they take breaks appropriately, or saying, maybe, "Don't do this more than three times, "before you take a break," so that they know it's not good to just like, hammer, hammer, hammer at it all the time. And then, intensity is not just about the cardiovascular load, so, in this case, hopping definitely got his heart rate up, but the intensity of the task was also the challenge of it, the difficulty level, and the mental engagement necessary to complete it. So, at this stage, he definitely cannot dual-task, while he's hopping, it's taking all of his focus and mental energy, just to work on, "I'm gonna hop and hit the cup, "I'm gonna hop and hit the cup!" And then, after we took the cups away, picturing, "Okay, I'm picturing the cup is there, "I'm trying to go as far

as I would, "as though the cup is still out there." But something that you can also do, as your patients improve and get better at these things, is start having them dual task, because that's very real-world! And so, for priming, prior to this, we engaged in movement-based priming, so, we did some aerobic exercise, and we also did some hip abductor strengthening, it depends on the patient, I don't always spend a lot of treatment time, on things like clamshells, or like, orthopedic, sort of strengthening exercises, in that sense, but, this gentleman drives from, as I said, he lives in a rural area, so he drives quite far, and we do a two-hour session when he comes in. So, we're able to spend quite a bit of time, working on the aerobic priming, working on motor activation of different muscle groups, that we're gonna focus on, and then taking it into a more, high-level, dynamic-functional task. Any other questions about Mr.A, before I kind of talk about, "Modifying for Different Settings"?

One thing that I thought about that I am sure would come up, would be the question in a more acute setting, of, "My patients are not ready to hop, they can't even stand!" And so, that's something that I'm very aware of, that I work with these patients, when they're far more chronic, after their stroke. So, I wanted to just break it down for you guys, and think about, "Okay, well, what am I asking "this gentleman to do, by hopping down the agility ladder? "Well, I'm asking him to do something that's "more challenging, but it's still attainable for him."

So, more challenging than just walking on an uneven surface, but I know he's able to get there, and I'm giving him that external focus of attention. So, the agility ladder, and trying to get his shoes outside the lines, or trying to hit the cup. So, for the motor skill that you're addressing, try to think of ways where you can increase the demand, just a little, but keep the patient's attention elsewhere. So, when I worked in inpatient rehab, with patients who needed more physical assistance, for a task such as standing, we would do a lot of standing on different surfaces, we would stand on towels, we would stand on a piece of foam, if you have an Airex pad, or a foam pad, or something like

that, we did a lot of reaching for things, and moving them to other spots. So, "Okay, you're gonna stand up, "and reach for the remote control, "and move it from the bedside table to the cabinet." We did a lot of laundry folding, so, we would stand at their bedside table, and I'd have some towels, and different things, or maybe their clothes from their room, and I'd mess them all up, and then I'd say, "Okay, we're gonna work on folding this!" And that's a really good way too, to use the affected upper extremity as a stabilizer, for their trunk support, so you're kind of helping them, especially if they have a flaccid upper extremity, get some weight bearing through that arm, and then have them fold with their other hands, or standing to brush their teeth, or comb their hair, we do dancing, we would do all kinds of silly things.

And I think too, that there's a lot of power, to helping someone uncover a new skill that they didn't know that they had, so even though we talked about the importance of somebody's motivation, that they need to feel that the task is reasonable for them to accomplish, and attainable for them to accomplish. I think part of our job, as therapists, and part of our skill-set, is to really guide them to the point of discovery. So, we can probably look at someone with our experience, and say, "Based on how they're doing, "I'm sure that they could do X, Y, or Z," but that person probably doesn't know that yet. So, just trying to have them do something that is just a little bit harder than where they think they're at, that's really powerful, because then, they're uncovering those new skills. And so, what about telehealth?

Can you do something like hopping on telehealth, or similar to the question that I had, about doing this as a home program? So, it's all about environmental setup, when someone's at home, whether it's on telehealth, or whether this is for their home exercise program, I often use countertops, have them use a countertop, or a table that's really sturdy, for support, if they feel like they're going to fall. You can have somebody stand, depending on how their home is set up, if they have a spot in a corner where they can, kind of put their back into the corner, if they're doing a more

challenging balance task, and then, if they were to fall backwards, they have two walls on either side, that's really good. I have people use plastic cups, cans of food, anything, I use a lot of kitchen things, but anything like that, for an external cue, so whether it's that they're going to do, even like standing hip abduction, by making sure that they're getting a nice range of motion, by giving them a cup there, that they're moving their foot towards, or a can of food, or if they're trying to work on, stance limb stability, on their affected side, that they're standing on the affected side, and then trying to move their unaffected leg, to tap a cup, or a can of food, or something like that, so that they have that external cue of, "Okay, I got to really be stable over here, "so that I can lift this foot high enough, "to be able to reach the top of a can of beans," or something like that.

And then, also for telehealth, I love telehealth with these patients, because if the caregiver is present, you can do so much caregiver-training. If they're there, and they're able to help, then you can show them where to stand, to support the patient, to make sure that the patient will be safe. You can give them instructions on how much help to give, because, I'm sure as you have all experienced in your clinical practice, as I have, a lot of times, caregivers give too much help. And so, they're really doing so much work for the patient, because that's in their mind, their job, they're a caregiver. but when it comes to rehab, we really have to have feedback, of the amount of assistance that we're giving.

So, that's a really good way, to kind of do some training and education with a caregiver, and dial in how much support that they're giving. You can also, for something like an agility ladder, hopping, you can just start with hopping in place, on a telehealth call, just to see how they're doing, and make sure they're safe with even just hopping in place, and have them near a stable surface, you can progress to hopping along the support surface. And like I said, using those external cues as guides, for having the person achieve a certain result with their movement, and at the end of the

day, you know your patient best. So, I'm not advocating for every patient out there, going and doing some kind of hopping task, but if they're appropriate for it, or if you think there might be a chance, that they're appropriate for it, I say, try it with people. And all it takes, is trying something with people, to see, get an idea of like, "Oh, this and that might work for you, "and this might not work for you." And, I think, if you don't do things like this, with your patients, I think you would be very surprised, by what people are able to achieve, if you give them the opportunity.

So, we'll move on to the second case study now, so, this is Mr.J, and if you recall, he is a gentleman in his early 60s, he had a right MCA infarct, so he has left hemiparesis, he's three years post-stroke, his early, kind of stroke recovery, in the acute care, and inpatient hospital, was complicated by some cerebral swelling, so he had to have a craniectomy performed. And, he has had his skull flap replaced at this point, so he's walking, typically standby assist, with a small base quad cane, and he recently progressed from his KAFO, to just an AFO. He wants to be able to require less help during the day, from a paid caregiver, so be safer and more independent in his home, and not need someone there all the time, to ensure his safety, and he also wants to return to some form of work, to feel useful, his words, "To feel useful again."

He was specifically targeting that independence, with in-home ambulations, let the caregiver maybe, just check on him a couple of times a day, while his wife is at work, and he doesn't need a caregiver there all the time. And he would like to be able to get around the community without a wheelchair, because in his mind, that is one of his big barriers to returning to work, is feeling uncertain about how he would get around a work environment, in a wheelchair. So, my plan was being able to get up from any chair you want, whenever you want, as safely as you want, is a large part of independence in the home. And, when I first started working with him, he had a lot of trouble doing that consistently, so I decided to work on sit-to-stands, to encourage more consistent left weight-bearing, and to help him be a little bit safer when he stood up. So, we'll go to

the video, and we do a lot of walking, I don't mean to characterize it as though sit-to-stands are the only thing I do with this gentleman, we do a lot of gait training as well, and gait training outdoors and up and down curbs, and ramps, but this is one area that I really wanted to highlight, for this gentleman. So, here he is, oh boy! So, he's doing his sit-to-stands, from a mat table, and this mat table is set to about 20 inches, so, he's a very tall gentleman, so getting up from a standard height chair is really challenging for him. So, we start off with a higher mat table, you can see that all of his weight is on his right leg, his left leg is basically off the ground, and not really helping very much at all.

And it's a little hard to tell from this angle, but he's also really pushing with the back of his knee, on the mat table, to get himself up off of the mat. So, his right knee is pushing against the mat for stability, which as we all know, with a chair, does not always work. So, I'm actually filming here, and this is from a sort of class that I teach, and so, there is a student volunteer, kind of guarding him right now. So, I asked him to do it again, and same result, so, I think to myself, "Alright, let's get really creative!" So, first we're going to put this step underneath his foot, it's probably three, somewhere in the neighborhood of two, or three inches tall, so hopefully, it's going to force him to use his left leg a little bit more, with a sit-to-stand, because his right leg is going to be at a disadvantage.

And as you can see, and as I'm sure you've seen, with some of your patients, he still is putting most of his weight on his right foot, so it's a little bit more activation at the left, you can really see patella is working over there. So, his quads are definitely firing a little bit more, but his weight is still predominantly on his right side. And then I thought to myself, "This will be great, nobody can do this, "we're gonna do a sit-to-stand, with his right foot "on a dynamic disk, that's even harder!" So, surely he'll put more weight on his left foot with this. And lo and behold, he still manages to stand up, and all of his weight is on his right leg, he has great dynamic balance on that right leg, so, you gotta

give him credit for that. You can see that his left hip here is retracted back, so it's actually moved out of its starting position, because he had so little weight on it, that it just sort of scooted back and around. And, really, it's just not helping very much, and nothing was working, to get this guy to put more weight on his left leg, although great balance on his right leg. And he's now, at least, you could see in that video, let me back up a little bit, you could see he's far enough away, I'll just point here. You can see here he's far enough away, it's hard to tell from this angle, but he's no longer pushing with the back of his knee, on the mat table there.

So, then, I thought, "Okay, well, let's go back to the box, "but I'm gonna have a second volunteer put her foot "behind his foot, so that it's really at a disadvantage, "biomechanically." So, it's far forward, it's on this box, he can't pull his heel back underneath him, to get his weight shift over that leg, surely, this will keep him from putting weight on his right leg, and he'll be on his left leg this time. And you can see he's better, but we're still getting really like quite a bit of movement, here at his ankle, so his heel is just fully, kind of sliding, so, all his weight is really still on his right foot there. So, okay, here was my ultimate solution.

So, this is a, let me get my pointer back here, this is me over here. I am actually just holding his right leg in the air, and you can't really see, but down here, I have my ankles crossed, and I have his right foot sitting on top of my crossed ankles, so, I'm preventing him from contacting the ground, with his right foot, and I told him, "You like me too much to crush my feet, "so don't crush them!" And then, over here, we have his left leg, and you can tell he's already starting out, in this kind of position, where all of his weight is over here, on his right leg, before he even goes to stand up. So, it's maybe not the ideal setup, in terms of his posture, before he even goes to stand, and for this stand also, we set the mat height a little bit higher, maybe like 23 inches, so that he wouldn't have quite as far to stand up. And so, that was our first attempt, and I said, "Okay, that was good, you got up, "but your hips were askew before we even

stood, "so let's make sure we have you sit down, "we'll get your hips squared up to the front of the table, "and we'll try again!" And, in this second attempt, you can see up here, his hand, he's actually reaching out to high five this other volunteer, who's over here. So, not only have we set him up to where he physically, can't step on the floor, we've got his hips set up how we want them to be, but now we're giving him this external cue of, "You're gonna high five this volunteer!" So we're not even gonna worry, about asking him to do a sit-to-stand anymore, he has to stand up to reach where this volunteers hand is, in order to get his right arm out that far.

And I've specifically positioned the volunteer, over here, on his left side, so that as he reaches forward and up, to high five her, he has to put more weight onto that left leg. And so, you can see here, she even gave him little bit of help, she was too nice, and she reached forward a little bit, to help him out, but I would argue, that this is the best position, that he's been in, as far as getting weight onto that left knee there. So, we'll back it up just a little bit, and you can see as he used to stand, that left knee is really it's gonna activate quite nicely, you saw though, he just had that little scoot, little cheater scoot, trying to push his hips out to the right, but that was much better, so we had a much better activation there at his quad, but that took a lot of work. and three volunteers.

So, let's flip back to our PowerPoint, if you don't mind. Okay! So, first we'll review some of the different, relevant motor learning principles, so in this case, we were trying to really tap back into his motivation, and I apologize, this is still referencing hopping. So, in this case, his motivation is to be able to walk more independently around his home, and he knows that, he has to be able to consistently get up from a surface safely, in order to be able to, say; get up and go to the bathroom, get up and get a drink of water, whatever it might be, that he wants to do. And this is something that he had identified, was really challenging for him, was he didn't feel comfortable getting up from a chair by himself, in his house. So, we're keeping the focus external, his most

successful trial, regardless of the surface that he was standing on, was the one when he was reaching to the left, to high five a volunteer, so we're giving him that external cue of, "you're gonna reach all the way up and over, "and try to high five this person." And you can even tell your patient, that you're not gonna worry necessarily, about the sit-to-stand itself, but if you give them a target that is sufficiently far enough away, and sufficiently high enough, that in order for them to tap that target or high five that person, that they're gonna have to stand up to get there, they will definitely stand up to get there, and they won't be quite so focused in, on their own body mechanics, and you'll probably see a much better result that way.

So, for feedback, again, I asked him to rate his own performance each time, rather than giving him specific feedback, and this is something we had been working on for a while, so he knew what kind of feedback I was going to give him, typically, so in this case, I just asked him, "How did that time go?" And he did actually, a really good job of telling me, "Well, I scooted my hips too far to the right, "well, my weight was all the way on the right, well, "on that one, I didn't keep my left foot on the ground."

And so, he was able to tell, and really identify the things that he needed to work on, so, volume matters. We practiced a lot, over the course of one session, with this particular task, and it's something that we've continued to practice, quite a bit, to the point that now he is sufficiently able to perform a sit-to-stand from a standard height chair, of about 17, 18 inches, just a plastic chair, that we have in our clinic. And he's actually able to do a sit-to-stand, keeping his weight more even out of a chair, while he has 20 pounds of additional weight attached to him, so he's even gained enough knee strength, and knee control, that he's now able to do that full sit-to-stand, with extra weight, so, quality matters as well. So, we didn't continue practicing any movement patterns, where he was biasing to the right, just for the sake of getting a high number of reps, of sit-to-stand, so, even though the volume is very important for getting good motor learning, you need to make sure that the person is doing it correctly. And then,

intensity is not just cardiovascular load, so, standing on a balance disk, or just one foot, is definitely challenging for the mind, as well as the body, and this gentleman did have a very, significantly challenging time, trying to balance on that uneven surface. And this was very mentally challenging for him as well, to try to figure out, "How am I gonna stand, "without putting weight on my right leg?" And it wasn't until we really got him focused on the external target, that he wasn't as worried about that. And then, so prior to performing this, it's a stand task, we primed the brain for learning this specific motor skill, by engaging in movement-based priming. So, we did aerobic exercise, and we also did some seated reaching, to activate his trunk muscles, and make sure that he was prepared, for the anterior translation, that it takes, to be able to get your weight forward, over your feet, and then up into a standing position, so we did some sitting, edge-of-mat reaching task, so, especially reaching to that left side. So, modifying for different settings, for this particular patient...

Oops, I have a question, real quick, "What kind of aerobic exercise did you do?" So, for this gentleman, we do a seated recumbent bike, and when I have the person on there, I have them try to target a certain number of steps per minute, based on what is challenging for them. So, we try to get to a certain RPE level, rather than monitoring heart rate, especially in this individual, he is on beta-blockers, so the heart rate is not as efficient of a way of measuring the intensity of the aerobic exercise, so I try to have them identify, when they feel like they're working about a six out of 10, on a modified Borg scale, and then I say, "Okay, so we're gonna try to keep the steps per minute "in that range!" "Will you be addressing nominal, "and functional task difficulty?" So, definitions and applications implementation, referencing test, and I apologize I can't quite get this, question to expand, but yes! So, talking about nominal and functional tests difficulties, referencing test questions one and two, yes! And we will leave time at the end, to go over some of the test questions as well, to make sure that we get those answered. So, for modifying for different settings for Mr. J, one concern I thought people might have, is not everywhere has a lot of support staff. So, some of the clinics

that I've worked at, some of the facilities that I've worked at, have a lot of volunteers, or have a lot of clinic aides, have a lot of rehab techs, and others not so much, you're kind of on your own, flying solo. So, I try to do a lot of environmental setup, to make sure that we're achieving the same goal. So, I'd use a lot of sticky notes, I use a lot of different things in the patient's room, when I was an inpatient rehab, so we would try to stand up and reach for a spot, on the top of the, in the hospital that I worked at, they had like little wardrobes, and so, we would try to reach for a box of tissues on the top of the wardrobe, or we would try to stand up, and reach for something in the closet, like on a hanger.

So, that's definitely a way that you can modify, if you don't have a lot of people, definitely, you can set up the environment, to make sure that also if you're by yourself, and you are worried about a patient falling, or having some kind of loss of balance episode, that you have something really sturdy behind them, like a mat table, or the hospital bed, just to make sure that, if they do start to lose their balance, they are able to sit safely on that surface.

If their caregiver is there, that's a really great way to get them involved, especially with things like working on a high five, making sure that they are aware of what you're doing, how much you're helping, where your body position is, so that caregiver education can start really early. I also like to, if there's grandkids around, it's really fun to have the grandkids get involved in the session, and that's really fun for the patient as well, or if there's some of the facilities that I've worked at, either the patient's pet has been in the room able to visit, or we've had therapy dogs, and so, if you are lucky enough to work at a setting, where you have a therapy dog, this is something great too, where you can have them work on reaching forward, to pet the dog, or reach forward for a dog treat, that they then have to stand, and throw for the dog, there's all kinds of different ways, that you can set up the environment, to make sure that both the patient is safe, but they have the external target that they're reaching for. Or if you don't have

access to balance disks, or boxes, or any of that, you can make a lot happen, either in home health, or at a clinic that has fewer resources with pillows, books. I really miss phone books, now that I've been in neuro-rehab, I'd never thought I would miss a phone book, but if you're able to dig up an old phone book, a phone book that's covered in duct tape, so it's a little more sturdy, is a really great tool to have as a box. Or, something that you can put, you could even have under the patient's foot, you can have it underneath their hips, if you need to get their hips to a higher level, if you don't have access to a high-low mat table, and you can need to just put books or something, in their chair, to get them up a little bit taller.

There's all kinds of ways you can get creative with duct tape, which, maybe, that will be another course that I do, it's like interesting therapy crafts that I have made, out of duct tape and plastic. So, for people that, say, maybe their patient needs more physical assist to stand up, so this gentleman in this particular video, wasn't needing a lot of physical assistance to stand up, he was just really standby assist, or contact guard assist, for standing. So, if you have somebody that needs quite a bit of physical assistance, you're having a block their knee, you're having to manage their trunk control.

You can, or you're trying to bias them towards their affected side, if you have a high-low mat, or if you have a hospital bed available, you can try to elevate it, so that they only have to stand through a partial range of motion, that can be really helpful for trunk support, if there's any kind of locking table, if there's a cabinet that's about the right height in the room, if there's a sink, anything like that, that they can use for a little bit of trunk support, and getting their unaffected upper extremity on there, so that they can study themselves, that stuff is really useful. I've done a lot of treatment sessions in bathrooms, because all that I had was myself, and all that I felt safe doing with a person, was in front of a sink and with their wheelchair parked right behind them, and a wall directly on their other side, so, on their unaffected side, so that, if they did start to

lose their balance, they had both the sink and the wall to grab, and then the chair was right there, so I could guide them back safely into it. So, there's definitely a lot of different ways you can get creative, and you can modify for different settings there. So, for telehealth, this is an activity that I love, as a part of sit-to-stand, and I've actually had a lot of my patients doing sit-to-stand-type activities at home, since we've been through this whole Coronavirus thing. So, it's a great way to take a peek, at what kinds of chairs they're usually sitting in, or chairs that they find it difficult to stand up from. A lot of our patients are hanging out in recliners at home, but they're really challenging to get up from, if it's really one of those, like low type recliners, so you can really work with the patient and their caregiver, on trying to make sure that their environment at home, is set up correctly, making sure that the caregiver is standing where they need to appropriately, how to help facilitate things that the patient is able to do as much as they can on their own, whether it be getting the patient scooted forward, to the edge of the chair, making sure that there's something for them to reach for.

Sometimes I'll have patients put a little end table, or a small, like a TV tray or something, out in front of their chair that they usually get up from, and I'll have them put like a box of tissues, or a television remote, or their glasses, or something physical that's very real on that table, so that it's that real external target of, "As I try to get up, I'm gonna reach for this, "and that's going to help pull my weight forward, "and a way from the chair, and up and out of the chair." Okay, any questions about Mr. J, before we go on to our last patient case-study? No? Okay, so, for case study number three, Mr. K, this gentleman is one year post-stroke, he had a thalamic hemorrhagic, he has some expressive aphasia issues, he is one, if you recall, when I first started seeing him, it was fairly recently, after his stroke, so I think about three months into his recovery, and he was having some really good neurologic recovery, in addition to functional recovery, so he came to me originally, using, predominantly, a wheelchair for mobility, walking with a large base quad cane for very short distances and wearing an AFO, and then we were able to progress him away from all of those assistive devices, so, that now he's just an

independent ambulator, both at home and in the community, but he's still feeling like he's unable to go back to work. So, he has a company that he owns himself, and they're sort of involved in manufacturing, so he's out on the floor, kind of supervising a lot of people, it's very chaotic, there's stairs, he has to go up and down, he's usually carrying something, and talking to somebody, at the same time, and trying to do all like three things at once. So, a lot of cognitive dual tasking, a lot of upper extremity motor control while he's moving, and just a lot of higher-level agility tasks, I really wanted to make sure, that he's able to have more automaticity of use of that right upper extremity, so that he doesn't have to think about using his hand while he's trying to balance, and also, that his balanced reactions are much more automatic, so that if he's talking to someone, and trying to give them instructions, or work out some complicated thought process in his head, while he's moving, he's not then having a decline in motor function, and potentially putting himself at risk of a fall.

So, the videos we're gonna look at, we'll talk about his early stepping reaction training, and that's where we'll talk a little bit, about some of the sensory reorganization work that we do. We'll show a video of his stepping reactions and progress, and then a video of high-level stepping reaction training, and then adding to it, with upper extremity and cognitive tasks, navigating a narrow space, and then, a fun video of him working on golf practice, because when he's not working he loves to golf, and so, he wants to be able to get back on the golf course. So, we'll go to video number one. Okay, and so, this is some early stepping reaction training, and you can see, here we're using the agility ladder, to give him an external cue of where he should try to place his feet, when he's stepping, so that I'm not having to cue him to take longer steps, I'm just saying, "Put one foot in each box, "going forwards and going backwards." He's pulling a loop, and you can see he kind of lost his balance there, so he didn't adequately use a compensatory step, to prevent a loss of balance there, but he's able to grab the rail. So, this is what we're working on, is if you're starting to get off balance, you're able to take that step, rather than having to rely on upper extremity support. And

you can see in this video, we'll get my arrow going here, he is not using his right arm at all, to grab for this rail, even though the rail is closer to his right arm. So, this is his affected upper extremity, this was several months ago, so, we're just trying to note that, he's really not using his upper extremity very functionally, at this point. You can see he has a five-pound weight on his right leg, and that is just to make him have to work a little bit harder, to move his right leg forward, so, we're really trying to overtrain that, and then, this 20-pound weight that he's pulling, I like to use this, for people to work on sensory reorganization, because it gives them some proprioceptive input, to a different part of their body.

So, frequently with a stroke, these individuals are kind of losing their proprioceptive input, and their sensory sensation from their affected extremity. So, if we can give them some sensory input from somewhere else, so we're sort of sensory priming, the hope is that, then their brain will start to kind of retune into the body, and get some sensation input from wherever it can. So, something that I do when I use this, pulling-the-weight activity, I did not do it in this case, because we're focusing more on step length, something that I will do sometimes, is have people pull the weight with their eyes closed, so, they're walking out towards a target, where I usually will put a chair, kind of at the end of this walkway, so then they'll feel the chair when they get to the end. And then, so with their eyes closed, and then, they'll have to walk backwards, back towards the target.

So, this whole time they're getting some sensory input, and some proprioceptive input, from the belt around their waist, and the weight at the end of it. So, we'll watch this one more time, and you can see some initial hesitancy, when he starts pulling that weight, difficulty getting that right lower extremity squarely placed in the first box, and there he goes! little bit of a balance difficulty there at the end. So, we'll take a look now at the second video, so, this is maybe a month or so later, and now we're working on having him have to really lift that right foot up, and to accurately place it, as he's going

over some targets. And there's my chair, and you can tell that it is very difficult for him, to put his right foot where he wants it to go, but I thought this was really important for him to work on, because the shop that he works in, there's just a lot of stuff all over the floor. So, I wanted him to be able to be very confident with the obstacle negotiation, so he's still doing probably 20 or 30 pounds of weight, that he's pulling, still really relying on that left upper extremity there, for some balanced support, almost grabs the chair but then does not, then we're executing a turn, and going back through this little minefield. Okay, so next thing that we'll look at, is the third video, and so you can see before I even get started, so this is not on the weight machine, this is, we've seriously ramped up the complexity of this task.

So, here we have a piece of foam, this is just an old piece of egg crate, bedding material, like, what some people put on top of their mattress, these are playing cards, and so, what he's doing in this task, is he has to navigate through the cone minefield, and there's two different heights of cones, over this foam surface, so, this unstable surface, and it's sort of slides around, on the wooden floor, a little bit too, and he's following a pattern set by the cards.

So, I forget, if this is following the cards in sequential numerical order, or if it's doing all odd cards, or all even cards, but I kind of switch things up on people, so that they have to change up their strategy a little bit. So, you can see there, he's stepping over with his right foot, and now he's trying to figure out where the next card is, in the order, and that was great! I just wanna highlight, we'll go back a little bit there, so, he's actually stepping here with his left foot, and that is a really large step with his left side, which is his unaffected side, so, that takes a lot of confidence in you're affected limb, to be able to take that large of a step, with the unaffected limb. So, he's got some great stance control, there on the right side, then he's trying to find some accurate foot placement there, it's pretty tough to get his foot in between all those cones, doing a little crossover step, which as we know, is very important for compensatory stepping

reactions, and another little crossover step, there. So, you can tell that this gentleman has come a really long way, from when he was just trying to step, in between rungs of the agility ladder, to stepping over just the large cones, and this is something that we practiced, not necessarily with foam, but we practice many, many times, with the weight machine, doing kind of stepping over cone minefields, with a mixture of low and high cones, doing different kinds of card sorting tasks, while he was doing that. And this was really, the first time that we had done, just doing this kind of a stepping task, without the weight, with a piece of foam, kind of out in the middle of the busy gym environment, where he had lots of distractions around him. I have a question here, that, "Wouldn't slowing the task, improve his performance?"

So, yeah, so in this instance, he's slowed down quite a bit, and so, he's being very thoughtful, and very careful, about where he's placing his feet, you can tell that he is really taking his time, especially at the beginning here. So, he stepped on this card, and now he's really stopping, to kind of plan, "Okay, "how am I gonna get all the way across, to the next card?" And that's something that in this early phase, this is still fairly a new motor skill for this gentleman, to a certain extent, like I said, this is the first time he's been on the foam, it's the first time we've done it in the middle of the gym, where people are going by him.

So, yeah, he's gonna be quite a bit slower to do this task, and just for reference, we actually, just last week, did a similar version of this task, where he had to find his way through some obstacles, and it was about this same distance that he had to travel, and his first repetition took him almost five minutes, to path-find his way through the obstacle course, is a little bit different than this, and the second repetition, only took him a minute and 45 seconds. So, that's something that you will see too, is that, as people get more confident in the strategies, that they're able to use, they get a lot faster with these tasks, even if you don't necessarily prompt them to get faster. That, that is a type of feedback that you can use for people as well, is to just time them, and

give them information about the performance of their task, based on the amount of time it took them. Okay, so we'll go to the next video. So, here we have a combination of an upper extremity motor task, and this obstacle navigation task, and you can tell that this is really challenging for him. So, we didn't add a cognitive component to this task yet, this is just, he's trying to navigate his way through the minefields, he's got the weight to attach to him, and he's trying to fish some dominoes out of this glove. This is a just a soft, almost like an oven mitt, and he's trying to fish dominoes out of there, with his right hand and then put them in his pocket.

So, this is something that, whatever spot you're at in the continuum of care, adding some kind of manual dual tasks, such as; putting something in a pocket, taking something out of a pocket, this can be very effective for just challenging different parts of a person's thinking, and motor planning, I have a few questions here. "So, while many of the techniques "do seem like they'll be great clinical benefit, "aside from strongly documenting a... Oops, let me try to expand this question here. Okay, "So, while many of the techniques "do seem like they would be a great clinical benefit, "aside from strongly documenting a patient function, "and capabilities, is there anything else you would do, "to mitigate the liability risk of using off label devices, "like duct-taped phone books, "does liability insurance cover off label use?"

That is a really excellent question, I am not sure of that answer! To be quite honest with you, I'm sure you would have to check with your liability insurance coverage, and see what the recommendations would be there. Typically, something like a duct-taped phone book, is probably a very low-risk device, and low-risk intervention, but I'm sure you have, depending on the setting that you work in, if you have patients that also have concerns, that's probably going to be something that you have to think about, as well. "Do we worry about the circumduction?" So, with this gentleman, while he's circumducting his foot, I'm not as worried about circumduction, in this instance, because he's even circumducting with his left leg, so, he's just trying to get around the

obstacles at this point, and he's just using an unnatural strategy, that you or I might use, to get around different obstacles there. So, he is able to get his foot over and clear. All of these obstacles you may not be able to see it in this video, but in general, he is able to, if I asked him to step directly over a cone, he would be able to clear his right foot without hip hiking and without circumducting. "He has sufficient hip and knee flexion for that?" That is a great question! So, someone else asked a question about, where the weight is attached to him? So, let me pause the video here. So, this is a gait belt, and you can't quite see it, but on the other side of this gait belt, is a carabiner, and so, the carabiner is attached to the gait belt, and then this cable, this kind of thin black line here is a cable, this is just a cable weight machine, like what you very commonly see it a lot of gyms in the community, and so, this cable weight machine right here, is probably set to about 30 pounds, and so, the cable just comes out and attaches to the gait belt there, so it's around his waist.

You can also, depending on the task that you're doing, you can attach the weight up high, if you really want someone to work on a lot of thoracic extension, while they're doing certain tasks. With this particular cable weight machine, we're able to slide the cable itself up and down, this silver column, so that we can adjust where exactly along the spectrum, or along a person's height, the weight is coming from. Okay, and then, I think we can go to the next video. So, this is the same gentleman, now I'm having him walk down a narrow walkway. So, we're really constraining his movement, and sort of in reference to the person who asked the question on circumduction, this is trying to get him to not circumduct his hip, and you can tell, so he's definitely walking very stiff-legged, on that right side, during this task, and it's because this task is very challenging for him. So, what I'm asking him to do, is now he's fishing dominoes, out of the little glove with his right hand, so, he's holding this in his left hand, he's fishing the dominoes out with his right hand, so, we're working on some manipulation. And then, his job was to pull out three dominoes. Excuse me! And add up all of the dots, and then give me the answer. So, we're doing cognitive task, we're doing a upper

motor manipulation task, and trying to get him to walk down a narrow pathway, and minimize his circumduction gait, and minimize the amount of times that he steps on the obstacle. And this is something where I did time him as well, and I gave him feedback, about his accuracy of counting the dominoes. So, the we use the same number of dominoes each time, I think it's like 10 dominoes, or 12 dominoes, and then he pulls them out in groups of three, does the math, hands them to me when he's done with them. You could also have the person put them in a pocket, or something like that, if you wanted to make it a little more challenging there. And now, I think, we'll go to the last video.

Okay, so this gentleman, like I said, is a golfer, and wants to get back to golfing. And so, I'm trying to have him do a golf ball pickup, this is very challenging for him, as you can see, we started off trying to use the golf club itself, but he was putting so much weight, on the club, through his left upper extremity, which is his unaffected extremity, that the golf club was bending, and I was afraid it was going to break so I got him this wooden dowel. And so, I had him using his strong side for support here, and then trying to reach down and pick up the ball, with his right hands, with his right leg behind him.

So, we did both variations of this, we did a variation, where he was using his left upper extremity for support, on the pole, and a version where, he is using his right upper extremity for support, on the pole, and he said that actually, this version was harder, because it's really hard for him to think about getting leg extension, at the same time as hip flexion, and trying to pick up this target. So, it was really hard for him to control his leg, while he did this, and I also modified the task a little bit for him. So, we're using tennis balls, which are a little bit larger and easier to grab, and I have the tennis ball up on this little box, because it was really tough for him to get all the way down to the ground. So, we did that, we also hit golf balls, and he is doing pretty well with that too, so, we'll have to plan some kind of golf outing for him, so that he feels ready to get

back on the course. And I have a question here, "With the same triad activities," so this is referencing the previous video, where the gentleman was doing a walking task, an upper extremity task, and a cognitive task at the same time. "So, with the same triad activity, "will it be helpful in treating for falls prevention, "in the typical elderly population?" Absolutely! This is something that I do, not just with my patients with stroke, but with the patients that I work with, who are at a falls risk, the more you can train, a cognitive dual task with a motor dual task, and then also, give them some kind of environmental constraint, where they're navigating around an obstacle, or through an obstacle course, I think the more realistic you can make it, for replicating their everyday life, because, even those patients are going to be, for example, going to the grocery store, fumbling with their cell phone, pushing a cart and all, reaching for cereal, all of those things at the same time, and so, you wanna make sure that they're able to balance all of those things without risking a fall.

So, great question. Okay, and so we'll go back to the PowerPoint, so, again, relevant motor learning principles here, we connected it to his motivation, we're keeping an external focus forum at all times, with this gentleman, I would do summary feedback, he would self-reflect, and I would have him watch videos, so that he could see his improvement. We did a lot of volume, he's another one who I tell him to rest frequently, so that we're not practicing bad patterns, we're really making it very intense on a lot of levels cognitively, as well as physically. And then for motor priming, for this gentleman, we would do some aerobic exercise, some lower extremity strengthening, and I also did a lot of wobble board training for him, for ankle activation, especially when we started to really, first progress him out of his AFO, I wanted to make sure we were getting as much dorsal flexor activation, as we could, so we would do quite a bit on the wobble board. So, some of you might be thinking, "Wow, my patients are so not ready for that!" In acute settings, you might be able to maybe not train stepping reactions to this extent, but you can work on building confidence with their affected leg, through stepping with a non-affected leg. So, in his instance, it would be his left leg, towards

targets, on the objects, over targets. A good way to build confidence, for people with stepping reactions, is to work on tandem walking, so heel-to-toe walking, or trying to get as close as they can, to a true heel-to-toe walking, depending on their patient's level, and how telling them, specifically, "if you start to feel like you're gonna fall, take a step!" So, that's a really good way, to elicit those stepping reactions and work on that. If you don't have a weight machine, which some people don't, you can attach a Theraband to stationary object, and have the patient walk against that resistance, while they do these things, I've had people do that setup at home, for telehealth and home exercise programs.

You can elicit stepping reactions through external perturbations, by using a Theraband or a gait belt, I often will enlist a family member for this, and it's kind of fun for them, to kind of get to participate and play around a little bit, with their family member during the therapy session. And then, as I mentioned earlier, if you're in home setting using canned food or plastic cups, as step over objects, you can use pillows, pots and pans, things like that as well, if you wanna have someone step over something larger, or a little bit wider. And so, for telehealth, this is pretty intense for these types of activities, I would typically ask someone, to have a family member present, or a caregiver present, to spot them if at all possible.

And if that's not available, then trying to modify, based on what is available, you can use household objects to create an obstacle course for the person, or like I said, for resistance walking, or giving postural perturbations, using a Theraband, a gait belt, a hand, or if they have kids and grandkids who around, you can get them involved by having them play some games. So, whether it's a balloon toss, a ball toss, blowing bubbles for the patient to pop, I've been known to encourage Nerf gun battles for patients, all kinds of fun things. So, I'm just gonna kind of whip through, just some parting thoughts here, and then I'd like to take just a couple of minutes to go over the quiz for everybody. So, this is a quote from Beth Fisher, she's a professor at USC, in

the Physical Therapy program, and she gave the John H.P. Maley Lecture, at last year's NEXT conference, and if you haven't really read any of her work, or seen her speak, I highly recommend you look this up on YouTube, this lecture, and she just said, "If we wanna reach someone's full capacity, "then we need to go beyond this limited choice, "that patients come up with on their own, "without a physical therapist; "encouraging potentially riskier, more difficult solutions "with what we know about brain plasticity, "it is our job to help patients experience "that they have more options." And what she's specifically referring to there, is movement options.

So, we wanna encourage these patients to take potentially riskier, more difficult options, and difficult approaches to things, while we're there, and while it's safe, and that's where I'm saying, kind of back to what we were seeing earlier, with your confidence so if you have confidence in yourself, and in your ability to keep the person safe, why not have them try something a little bit outside the norm, or a little bit outside of what you would normally do, and I think you'll be surprised, and I think your patients will surprise you. We'll go through some of the questions, real quick. So, question one, nominal task difficulty is defined as, A, how difficult the task is for the individual learner, how inherently difficult the task is, based on training requirements and conditions, or how challenging it is for a group to perform the task, or how difficult it would be to replicate the task at another environment, so, the correct answer there is B. So, nominal task difficulty is defined as how inherently difficult the task is, based on training requirements and conditions.

Question two, functional task difficulty, is defined as how difficult the task is, for the individual learner, and that is the correct answer. So, functionally the task is very difficult, or not very difficult for that individual learner. Question three, motor learning is maximized, in terms of task difficulty, when? And the answer there is C, the learner gives input about the parameters of the task, to suit their own abilities. And this goes back to the OPTIMAL theory of motor learning. Question four, all of the following are

examples of nonverbal forms of explicit feedback, and knowledge of results, except? And the answer here is C, giving the learner a description of what was correct about their performance. So, that is a verbal form of feedback, so that is not correct.

Question five, ideas for multi-sensory input that helps improve motor learning include? And the answer is, all of the above; haptic stimuli, auditory stimuli or visual stimuli.

Question six, for patients with impaired mobility, but high internal motivation blank, can make a huge impact on their ultimate recovery? And the answer is A, so well trained supportive caregivers. So, then they're getting the volume of practice necessary, for success.

Question seven, therapists have a role to play, in modeling appropriate goal-setting for patients. Which of the following are an example of reframing a goal that is meaningful to a patient, but also attainable? And the answer is C, both A and B are correct. So, you might say to someone, "If your goal is to walk normally, "let's set a goal for you to walk from your recliner "to the bathroom without needing help." So, really scaling that back a little bit, or answer B, you wanna be able to go to a restaurant with your family, so let's practice walking up and down a ramp, so you can get into the restaurant, and then, scooting sideways in a seated position, so you can get into a booth.

So, making those things very meaningful and relevant to the person. Areas where a physical therapist can help a patient set appropriate goals include? Answer D, all of the above, so; household activities, hobbies and recreational preferences, such as golf, community navigation and reintegration. Question nine is, in a rehab setting with limited access to specialized equipment, or support staff, the intensity of tasks can be increased, by increasing the blank, of the task, while still maintaining patient and therapist's safety. And the answer here is A, increasing the difficulty of the task, so difficulty for the patient, not necessarily difficulty for you. And question 10, telehealth visits can be used strategically for? D, all of the above. So, checking in with a patient, school-setting in progress, ensuring that caregivers are providing proper guarding, and

cueing during tasks, or taking a virtual tour of the patient's environment, to find ways to seamlessly integrate their home program into their lifestyle. Sorry, we went a little bit over on time, but thank you all so much for joining me today!

- [Calista] All right! Well, it looks like we got all our questions answered, so we're gonna go ahead and close out for today. Thank you, again, Dr. Compton, for a wonderful course, and have a great day everyone!