A Pilot Study of Strength Training in the Memory-Impaired Elderly: Reflections of a Coach

by

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"You have to have a little sachel [sense] and a little mazel [good luck]", Sara used to intone when we met. In fact, she would impart the same Yiddish wisdom with the same words every time we met. This was one of the important messages that seemed to have survived the slow but progressive deterioration of her memory, and although she didn't remember having shared it with me before, she was always generous with her ineliminable bits of wisdom.

Sara had earned a six-month prize in a pool of applicants to participate in a pilot clinical study evaluating the effects of strength training on outcomes relevant to dementia, like cognition and frailty. It was my responsibility to teach participants – both those who had no cognitive impairment and those with memory problems and dementia – how to strength train in the structured environment of an assisted living facility.

For as much as they were my students, I was theirs. In my time with the study I learned a few things about training the frail, cognitively impaired elderly, and many things about the ravages of Alzheimer's disease that went far beyond barbells.

The pilot study had several goals: 1. To determine whether an elderly sample including those with progressive memory impairment from neurodegenerative disease (Alzheimer's disease) could be coached in proper strength training technique; 2. To determine whether stress-adaptation-recovery cycles would result in increasing strength and reduction in frailty; and 3. To investigate whether molecular mediators produced by the body in response to this stress could aid in cognition and memory.

The premise of the intervention is anchored in the application of Selye's General Adaptation Syndrome. The pilot was predicated on the hypothesis that Selye's stress/recovery/adaptation cycle could be employed to generate adaptation not just to the physical stress of training (strength) but also would generalize to a cognitive adaptation manifesting itself in improvements in memory testing or a reduction in the rate of decline.

The biology that makes this effect plausible comes from evidence that building skeletal muscle can produce molecular mediators that could enhance cognition non-specifically, or may have a more

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direct impact via modifying the underlying brain pathology. A comprehensive review of this science is not the aim of this memoir, but can be found in the literature. The aim here is to tell the story of a couple of remarkable women and to provide some guidance for those who will inevitably carry this work forward in an aging population with a ballooning incidence of Alzheimer's disease desperately in need of the benefits that strength training can provide.

Sara was an 85-year-old widow suffering from cognitive impairment who had resided at the facility since the death of her husband. Her daughter was very invested in her mother's participation in the program and she helped to schedule her visits and encourage compliance, even sitting in on many of the sessions. "She's going to kill me if I don't cooperate with you, I better do everything she says, or else" Sara joked with me each time.

Her daughter was a busy professional and taking time out in the afternoon to sit with her mother in an hour-long session was probably not what she had planned when taking her job. Nevertheless, her presence encouraged participation and her name carried much weight during our negotiations in the hallway. "Okay, we can just do one thing because I'm so tired today and I feel under the weather a bit, so please be patient with me," Sara said weekly.

I would offer Sara my arm to walk down the hall and she accepted graciously. "Why thank you, that is very kind of you." I could tell that this was a novelty to her, a gesture of respect and formality at this stage in life, in this modern culture. My grandmother, my mother and my aunt all strolled together arm in arm as I grew up, a throwback to Russian customs, and something which I embraced in childhood. I learned that communicating this way disarmed Sara and made her feel safe.

Over several sessions, I began to grasp what it means to be close to someone with a progressive memory problem. Sara was aware of her memory loss but in our sessions she did not seem to worry about it, placing full faith in her doctors and her family. She was able to remember the names of her children and grandchildren but she had a difficult time remembering mine or what activities she has scheduled for the day.

It was clear that most of her trouble was with making new memories. She was able to remember to check her mail but did it multiple times a day, discovering an empty mailbox each time after the first trip to retrieve her mail. The mail area was a popular gathering spot, sometimes cluttered by a tangling of walkers and canes. This was the location I usually retrieved her from when it was her turn to train. She moved through her day guided by the implementation of a routine provided by an assisted living schedule – attending meals, recreational activities and the occasional doctor visit.

I learned an important distinction in the way memory works – between declarative or explicit memory (things we know that we are aware that we remember, like where you left your keys) and non-declarative or implicit memory (memory that we don't have to attempt to recall, like how to drive a car or dance a waltz). Although Sara could not remember things that happened recently when asked, her brain clearly encoded memories for how to properly position her body when addressing a barbell, where to grip, how to control breathing. Although cuing was required, the results were similar to what you would expect from any other senior, and were in stark contrast to the general fog of her memory of very recent events.

There is evidence that those suffering from Alzheimer's disease learn motor skills implicitly by doing even when explicit learning capabilities have been vastly eroded.

In developing and implementing a training program for Sara, even while taking advantage of implicit memory, I quickly learned that more than cues would be required to facilitate her training. I had to learn what made Sara nervous, how to anticipate her anxious preoccupations, and what I could

do to avoid having this anxiety complicate the application of stress in weight training. Anxiety is a very common feature of Alzheimer's disease, and can manifest as outright worry or fearfulness or can be masked with restlessness and fidgeting.

It took several sessions in order to be able to sense the changing weather of her fears and to be able to sooth her to make the training sessions possible. "I don't want to do anything that will make me unable to spend time with my children this holiday," Sara requested of me every time we got to a point where the weight felt heavy for her. It took me some time to understand how important exploring anxieties and allowing for a safe space for open communication are in training this population.

Sara looked forward to the time she spent with her children and grandchildren, but this was also commingled with anxiety; she spoke about her granddaughter quite lovingly and she often told stories about her. "When I gave my granddaughter her first car, I had it checked and double checked. I wanted to make sure nothing would ever happen to the car that might harm her." Sara herself had stopped driving after she became confused while on the road one day while she still lived on her own. "My children come to pick me up for lunch often and I let them drive the car because I am having trouble with my memory."

Scheduling and routine are a source of unique complications in the memory-impaired population, even for those in structured living. At each visit, I would have to disturb Sara's structured routine and coax her to agree to do hard things, things that her body had not done in years. "Please don't stand on ceremony and please feel free to call me in the morning to remind me about the appointment," Sara used to say to me each time after I had to track her down in the facility.

For a memory-impaired person a "scheduled appointment" is not much more reliable than an unscheduled drop in; for people living with this kind of impairment, conversations and agreements from the past are not an organizing force for the future, and outside of big family events there is little anticipation of what's happening next. The distant past and the immediate present loom very large.

Sara could never remember our appointments no matter how much her daughter, the front desk, or I reminded her in advance. Each time that I found her in the hall or in the lounge relaxing (eating cookies and drinking soda), I would have to reintroduce myself, reminding her who I was and what we were supposed to do together. I doubt she would have come with me even once to train if it were not for invoking the correct verbal code. The residents I coached with memory disorders each had their own. These were safe words that calmed her and things she could recall, thereby placing trust in me again. Sara's safe word was her daughter's name.

For each of the residents in the program, training was twice weekly, following lunch and before dinner. In Sara's case, we started on a box, doing sit-and-stands for three sets of five until she got just below parallel where she learned to hip-drive off of the box. At the onset of training, she was clearly deconditioned. Remarkably, Sara was able to learn –implicitly – to lean over enough to stand using her hips first without the fear of falling over, and over time she began making the adjustments that we had worked on, demonstrating that these movement patterns were encoded in her brain.

I was surprised by how much effort she could put into the lifts, and how well her body responded with adaptations. It became clear from Sara and other residents I worked with that training sessions could not be focused exclusively on the motor task at hand; their minds did not really go there, even if they were adherent with the program and executed the task flawlessly; the near constant focus of their attention was their family. This may have made the instruction more implicit, and the ability to distract themselves from the awareness of the task may have actually been adaptive for them.

Conversations between sets were mostly autobiographies with protracted reminiscence about their families, and their memories were the clearest the farther they receded into the past. It became

clear to me early on that coaching with this population is largely a form of therapy, with the barbell providing a discrete motor responsibility freeing up other parts of the brain in desperate need of ventilation. I observed that the better the flow of the conversation, the more successful the training session.

Under the influence of stress, recovery, and adaptation, Sara progressed and her lower body became stronger, her technique improved, body and brain seeming to synch around a task that did not require effortful recollection. Over several sessions, I had progressed her to box squats with a 15lb kettlebell. This was quite a challenge for her at three sets of five. When we first started, her exercise tolerance was limited, and she was quite challenged in a session by a lat pull-down machine at three sets of very light weight (15lbsx3x8). She was tired after just one exercise. As training progressed, this rapid fatigue became less an impediment. Not only had Sara become stronger, she had gained endurance, making it easier to add exercises to her training sessions.

But just as things seemed to be really improving, progress stalled. It had nothing to do with the training, or her body's ability to adapt to it. During one of our last sessions, Sara, at the mention of her daughter, told me earnestly "Let me tell you something, everybody needs a daughter. I love my sons and I could not live without them but nothing is like a daughter to a mother." I agreed with Sara, in fact, I identified with her. I have a daughter, born to me after two boys, exactly like Sara. "Have you ever heard of the Molinicu?" Sara pointed to the top of her head. "Look at the top of your son's head and look at the direction that his hair grows in on the top of his head. If it swirls to the left then the next child will be a girl and if it swirls to the right then it will be a boy." Sara had a system based on the circular direction of hair whorls and she swore by it for detecting the gender of the unborn baby.

You can bet I went home and looked at the tops of my kid's heads to double check this bit of wisdom. Although our training together had ended prematurely, Sara taught me that the key ingredients to success with the memory impaired population have less to do with the physical work required, and much more to do with the strength of relationships, in and out of the training session. In Sara's case, her disease did eventually rob her of the initiative and interest required to participate in strength training, but not before what was possible became apparent.

Linda, another participant with a memory disorder, was 86 years old, and widowed. Linda's session was directly after Sara's, but sometimes they overlapped. When the two ladies encountered one another in the training room they would joke about the exercise and complement one another after a set. Outside the training session they seemed to be strangers, unfamiliar as if they never met. That took some time to get used to, and it made the reality of the disease they suffered from shockingly clear. I reintroduced them each time.

Linda's daughter was a special education teacher and visited her quite frequently, providing encouragement for our sessions and helping us to identify trigger words that would make Linda amenable to training. Linda also lost a husband she loved dearly, of whom she spoke in almost every session. "John was a very handsome man, I loved him very much. Did you know I met him at a millinery shop?" Linda told me the story of their meeting every week, how they met, how he courted her and how they raised a family, living lovingly together for almost 60 years together.

"I can't believe this is my life" Linda used to say to me. Sadness would overcome Linda in most of our sessions. It became clear that mood was something I would have to contend with, and manage.

Depression is a part of Alzheimer's disease, occurring in up to 50% of those afflicted It's challenging enough to work hard when you are having a happy stress-free day, but to be sad while training is an obstacle that needed to be overcome thoughtfully and often.

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I can recall a session in particular when Linda told me about her beloved husband for the first time and she began to cry. She was completing a bench press set and I could see her expression change. Thinking it was related to the exercise, I asked her if something felt wrong. "I miss him so much, I think about him every day. I can't remember a time without him, we were married very young after he came out of the army." John's father owned a millinery shop – a place where hats are made – and Linda was hired as a model for hats when she caught his eye. "I used to be beautiful, and he saw me one day in his father's shop and we fell in love."

Linda's session was always vulnerable to being sabotaged by the movie theater schedule. Assisted living facilities like the one I was coaching in are replete with activities throughout the day, and also have facilities including billiards and cards rooms, and in this case a movie theatre that showed mostly oldies in the afternoons. The first two things I would ask upon entering the facility were "Is Linda still having lunch? What movie is playing today?"

Linda loved to watch movies, not just any movies but specifically dramas and love stories. Curiously enough, she did not enjoy sad plots or scary plots. The anxiety produced by the story line would make her uncomfortable and upset. Linda was a good movie critic although she could not tell you what she watched once it was over, only that she watched a film and she thought it was "pretty good." My challenge was to catch her before she walked down the hallway to the theatre.

Linda chose watching movies over training once the picture started, and I do not blame her one bit. In fact, I had spent many sessions sitting behind her after failed attempts of coaxing her out of the theater. "I'm in the middle of the movie, can we train tomorrow, I really don't feel up to it today." I think the first time she said that to me was at the start of Cinderella Man. I tried three times on that day to convince her to leave in the middle of the movie, only to be summarily shushed by a squad of fellow viewers, all over the age of 80, and I was not messing with them. I watched Cinderella Man that day before I left, sitting behind Linda in the theater, no match for Russell Crowe.

Linda's sessions were directly after lunch but had to be before the afternoon film. This meant that I trained Linda on a (sometimes) full stomach, not an ideal condition for a training session. In an ideal scenario, every client adheres to a proper nutritional plan, gets enough sleep to recover, and is able to fuel correctly prior to exercise. This is even more important in an elderly population. In Linda's case, she stayed at lunch until her last course of coffee and desert, enjoyed at her usual table with other women from her facility. Although it wasn't always clear to me that she took advantage of this socialization opportunity, I considered it her social time and did not want to intrude.

Sometimes, though, if things went too late, I had to meet her in the dining room. "Linda it's time for our session, I am here to take you to exercise, Dr. Price wants you to exercise so that you stay healthy." Linda was instantly agreeable upon hearing her doctor's name invoked. Linda would politely wipe her mouth from the last bite of desert, turning to the other ladies and explained whom I was and what she was going to do later. I had the sense, although I could be wrong, that to the other residents this put Linda in a special category, and she enjoyed the impressed looks on her tablemate's faces when I would escort her from the lunchroom.

Linda was a pleasure to coach, and the chasm between her declarative memory deficits and her ability to learn implicitly the procedural tasks of barbell training was the widest. Those who had an opportunity to see Linda train – family, study personnel, resident bystanders – had a predictable jaw-dropping response to watching Linda get in position and execute a perfect deadlift. Linda's deadlift is itself testimony for all of those skeptical about training this population, that what is possible for the cognitively explicitly intact elderly is accessible also for those with dense implicit memory impairments.

We got quite far in Linda's training. She learned to leg press, bench press, and deadlift. Barbell training is a technical skill, which requires the participant to practice and build on his/her skills with each training session. Linda remembered how to deadlift although she could not remember when her appointment was, or even that she had ever done it before. She almost always said with a smile, after being congratulated for a perfectly executed pull, "I have never done this before." In the beginning, I reminded her that she had, but then I gave up. It didn't matter whether she was aware that she remembered.

Teaching Linda to perform each exercise followed a pattern similar in many ways to training the non-memory-impaired adult, although I could never say, "Just like last time…" or, "remember to…" I had to give the cues in the moment and eventually they were learned. I was initially able to teach Linda to bend down and not lose balance, to set her back with each rep, and to keep the bar on her leg. I repeated those steps with each set, teaching them as if for the first time, and it quickly became clear that she could be successfully coached. She started at a 25lb deadlift and progressed to 55lbs. Although her awareness of her own recollection was not there, her body remembered how to hold the positions. With similar cues to coaching any novice on the deadlift, she responded and corrected mistakes in her form.

An episode from Linda's training stands out in my memory as one of the highlights of my time working on this project. I had prepared the bar for Linda on the ground and it was going to be her first deadlift warm-up set. I was getting ready to recite my mantra of "step up to the bar until it is over the middle of your foot Linda" and then it happened- she stepped up on her own, bent down suddenly to grip the bar as I had taught her in the past, and prepared to set up all on her own. I couldn't believe my eyes, and it's a good thing that I had my hands on her and I was right next to her because she wasn't waiting for me to do her deadlift. "I know what to do," she exclaimed, as if this was something she always did. I looked at her and tried to hide the surprise on my face, "Of course you do, go ahead Linda, set your back," I instructed. Linda proceeded to do five perfect deadlift reps that day to my amazement.

In fact, Linda also began to grip her bar correctly on the lat pull-down; previously she had to be directed on proper hand placement. She turned her feet out correctly on the squat and started to be less fearful of applying bigger effort to the movements. In my opinion, Linda had changed in subtle ways and I could see it in and out of the weight room. I no longer had to reintroduce myself when we met at her lunch table, and she greeted me with a warm smile in the hallways. I taught Linda to deadlift, and Linda began to remember me. I can't prove that those achievements are connected in any other way but sequence in time, but there it was.

Training the client with a memory disorder like Alzheimer's disease requires a level of personal intimacy that would normally be counterproductive in non-impaired population. How do you convince a woman mourning her husband as if he had just died today to continue her session? How do you engage someone at a critical point in a training program when they feel an acute sense of loss that they have trouble articulating?

The solution that I found was not in avoiding these moments or attempting to shoo them away, but learning how to give the client an opportunity to hold on to and express a memory while not becoming so overwhelmed with feeling that training is impossible. Sometimes this requires becoming more involved in the family dynamic than coaches typically do.

On one occasion, I sat listening to Linda reminisce about her husband tearfully, and afterwards I asked to see a photo of her and her husband. Her daughter brought it in the next week and we looked at it nostalgically together, Linda was in a beautiful hat, smiling blissfully next to her handsome

husband, both dressed in classy suits. I memorized Linda's story so closely that I learned how to steer her away from the sad moments she recalled and deflected her to different scenarios in their love story that did not upset her. "Linda, what was John's favorite meal? I bet he loved your cooking." I would encourage story telling from her that evoked happy memories and kept her moving during our training session.

An unanticipated reality of training the memory-impaired population involves participating in the quest for lost items, real or imagined. Losing or misplacing things, or the fear of either, looms large in the minds of those with memory disorders and can derail a training session. Uninitiated to this, I learned that a preoccupation with perceived lost items could emerge out of nowhere in the midst of a session and could make Linda or Sara feel too anxious to train, and scavenger hunts would commence with me taking the lead. If I was looking forward to a session because we were about to set a PR (personal record) and the notion dawned on them that they lost their cell phone during the session, then what we were doing for the session was searching for their phone instead of setting a deadlift milestone. If I were planning to teach a new movement that day, and jewelry was felt to be suddenly missing, then we were not training, but instead were retracing steps in search of heirloom pieces.

The fear of theft, the most common fixed false belief in the memory impaired population was often a subtle but looming sentiment and it was important to be sure to keep purses in sight in order to avoid panic that it may have been stolen and the session aborted. As much as I could, I acted as a surrogate brain so that memory-related anxiety did not have to dominate the sessions.

"What was it that I wanted to do?" Sara would ask with a bemused look on her face while holding up her arm, a key on her wrist. "Oh, you want to use that key to check the mail at 2:30 today," I would reply. "And what time is dinner today?" "Your dinner shift is at 5:30pm and you wanted to take a nap before dinner. Make sure to eat some good protein after our session today."

Neurodegenerative disease can have indirect and direct effects on basic vital functions that impact training such as hydration, thermoregulation, and appetite. Keeping a client hydrated is challenging when they cannot remember to drink throughout the day on their own; this is a larger issue during the summer months. Complaints of fatigue, headaches and dizziness can be signs of this, and I learned to spot them early and to make sure that hydration, even in the absence of thirst, was a part of the sessions.

Loss of appetite is common in neurodegenerative disease, and is compounded by the anorexic side-effect of the most commonly prescribed although only modestly beneficial medication class, the acetylcholinesterase inhibitor. Coaching in this population requires a very hands-on approach to diet, and it is critical for the coach to have access to and influence over meal planning and adherence.

Appropriateness of attire is an important consideration in training a population of those who have largely lost the abstract cognitive tools required to dress for a particular purpose, like athletics. Dressing – along with grooming, toileting, and feeding – is a basic activity of daily living that is eroded in Alzheimer's disease. In the case of Sara and Linda – partially a result of their cultural generation and partially a result of their disease – they generally dressed in an overly formal way. They usually dressed as if they were attending a social engagement, often adorning their favorite jewelry, putting on a fancy blouse and dress slacks. Although fashionable, it's quite difficult to squat in a pair of slacks and nearly impossible to do upper body work in a dressy blouse and slip-on slides that have no ankle or foot support.

My coaching involved making executive decisions about what was to be worn to the session, usually coordinated with family. Shoes deserve special attention. The day Sara came in with a pair of

slip on shoes was also the day she began practicing her sit-and-stand from the box. The wrong shoes in this population can complicate preexisting balance issues and promote falls. "Shoes do two different jobs in barbell training. They support and protect the feet, and they provide a little heel lift to help with quadriceps recruitment even as you stay in the hips." In this frail population, the right shoes can be a fall prevention device. In working with the memory-impaired population, the importance of proper attire may necessitate leaving a change of clothes or shoes in or near the training space, as it is unrealistic to rely on the client to dress for the occasion.

Balance is commonly affected in Alzheimer's disease, and can progress as the illness worsens. Training sessions require a level of physical supervision from the coach that may not be required in a cognitively healthy elderly population.

As my work with Sara and Linda involved teaching them to bend over towards the ground, I had to be by their side at all times, ready to grab on to them if they started to lose balance. It became clear that the ideal scenario is to have two coaches – or at least one coach and an assistant – working together to manage the fall risk in this population, one to hold them and one to coach from a safe distance. These clients cannot be told to load their own bars or to walk over to retrieve a clip for their bar as we are accustomed to doing with a healthier population. They must be seated in between sets resting within your sight while you do all the setting up.

When Sara or Linda would bend down to pick up a deadlift I was right next to them with one hand blocking the front of their shoulder and another on their back. This gave me the chance to help them regain balance if they swayed forwards or backwards. In this population, from the moment they enter the room, a coach's eyes must always be on the client and a steadying hand close by.

I wish my story had a completely happy ending, but much like the disease I was trying to impact, it doesn't. Sometime over the course of our training, Linda's daughter had reported to me that she had found an X marked on her mother's calendar in the place where our training was scheduled. She asked me if I thought this strength training was helping combat the disease. I wish I had a real answer for her but all I could say was that we hoped that building muscle could create molecules, which would help repair the affected brain of her mother.

The key word here being *Hope*. If I could have gotten Linda to continue training consistently and rebuild herself into a stronger person, I am convinced her brain function would improve. I am an optimist, and I believe you must be optimistic in order to participate in research of any kind, whether you are the one providing or receiving the experimental therapy. Unfortunately, Linda and Sara both were unable to complete the training protocol to the level of adherence that I would have liked.

Linda stuck with it until the end of six months but she started to miss sessions towards the end and became gradually weaker, eroding her previous gains. She seemed more distant, more distracted by internal preoccupations that had to do with her past, missing her husband. Sara lost momentum after three months and became gradually resistant to training. It was not the strength training that stalled in this case; it was Sara's willingness to participate, which deteriorated. "I don't remember making an appointment." "How often do we meet?" " I don't have energy today." "Can we stop after this exercise?" "I can't stand up." The resistance to training grew along with her ability to work hard within the session and soon she blatantly refused to come down from her room. Even with the greatest attempts from her daughter to encourage her mother to participate, Sara eventually refused to train. In the sessions leading up to our last session Sara would complain of discomfort, become anxious, forgetful and non-compliant. I ran out of magic tricks that would coax her into training and our progress was halted.

Towards the end, in both cases, I could see the progress being undone, and that was disheartening. Endurance fell off the quickest. Linda became breathless quite easily once she stopped using her legs for exercise and Sara was only able to complete one exercise instead of two before becoming fatigued.

Following the final sessions, I watched both women wander through the hallways of the facility as I continued to train another participant. We smiled at each other as we passed in the hallway, but each of them seemed surprised by my greeting them by name, as if we were strangers. As my experience in the pilot ended, I was left alone with all of the memories and submitted the training logs to the research department.

Although the files will show dates with exercises and numbers, they reflect much more than a collection of data to me, and whatever success there was can't really be measured for me quantitatively in strength achievements or improvements in cognition. Sara and Linda taught me that this can be done, that even the very frail and confused can get stronger, but as in everything else, you have to have a little sachel and you have to have a little mazel.

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