Session Title: **Alzheimer's: Let's Prevent it With Everything We've Got!**
Presented by: **Christine Conti,** *Content prepared by:* **Jonathan Ross**

Takeaway Message: Alzheimer's does not "come out of nowhere" – it comes out of everywhere! It is the fastest growing cause of death and has no cure. Even though never getting a disease is always better than "defeating" it, avoiding illness does not give us an "enemy" to "attack," is not as dramatic and moving, and does not have a colored ribbon. It is why we have "war movies" not "peace movies." It seems odd to "rally the troops" for a "prevention battle." Where there is avoidance of conflict there is no drama, and we are irresistibly drawn to drama.

And when it comes to our health, we suffer for it. We often wait until we get a disease and then fight it with everything we've got. A more sensible path would be to *prevent it with everything we've got*. For too many people it seems that "an ounce of prevention" is not a heavy enough burden to bother with and instead wait for many pounds of cure to carry. Health is too often a product to buy when sick rather than a way to live to enhance vitality. And even though about half of middle-aged adults worry about getting dementia, we know that nowhere near half of middle-aged adults live a consistently healthy lifestyle.

Physical Activity

Since physical activity is woven so essentially into the human experience at any age regardless of disease status, it can be difficult for many people to fully appreciate the positive impact that physical activity can have on brain health.

Specifically, physical activity creates enhanced blood flow *and together* with cognitive demand leads to enhanced (Sherzai, 2019):

- Growth of new brain cells (Neurogenesis)
- Connectivity between neurons (Synaptogenesis – the creation of new synapses)
- Formation of new blood vessels (Angiogenesis), essential for nutrient delivery
- Production of brain growth factors (Neurotrophins): BDNF, NGF, VEGF, FGF-2, IGF-1

Additionally, the hormone irisin, secreted by working muscles during exercise, crosses the blood-brain barrier to improve cognitive function and reduces the neuroinflammation implicated in Alzheimer's. (Islam, 2021) Exercise has been shown to increase cognitive function at all ages, with a higher degree of benefit shown in people who are older. (Stern, 2019)

BDNF to the Rescue

There are numerous compounds involved in keeping our brains healthy that are enhanced by following a healthy lifestyle, but one deserves special mention: Brain-Derived Neurotrophic Factor (BDNF).

BDNF is the premier member of a powerful group of proteins called neurotrophins – helper molecules that allow a neuron to create, maintain, and protect connections with its neighboring neurons. The brain cells most sensitive to BDNF are in the hippocampus. The more BDNF you have, the more protection you enjoy against brain disease.

All exercise increases BDNF in general. However, we will see how blending specific elements into physical activity can enhance BDNF production over and above amounts produced from traditional exercise.

The Rest of the Neurotrophins

Exercise and physical activity increase:

- Nerve Growth Factor (NGF): enhances spatial working memory and functioning of the hippocampus by enhancing activity of the neurotransmitter Acetylcholine, which is essential for memory formation. (Hall, 2018)

- Vascular Endothelial Growth Factor (VEGF): helps build new capillaries within the brain, enabling greater delivery of oxygen and glucose (fuel) to brain tissue.
- Fibroblast Growth Factor-2 (FGF-2): helps in the formation of new blood vessels. It is also involved in improving some brain functions such as improving synaptic efficiency and affinity between neurons to facilitate learning and retention.
- Insulin-like Growth Factor-1 (IGF-1): an insulin-like anabolic compound manufactured in the liver and active muscle cells. IGF-1 is stimulated by increased levels of human growth hormone (HGH) after certain types of exercise (e.g., hypertrophy training, formats inducing metabolic stress like those with shorter recoveries – HIIT). IGF-1 helps promote increased glucose passage into the brain for fuel through the blood brain barrier (a web of tightly packed capillaries intended to filter compounds and prevent them from entering the brain). It also complements some actions of BDNF.

The Alzheimer's Fitness Specialist Course features nearly 100 exercise videos and specific ideas and examples of how to integrate cognitive challenge with physical activity and exercise to optimize the brain benefits of physical activity as outlined above.

Lifestyle – Promotion or Prevention of Disease

There are numerous health and lifestyle factors related to Alzheimer's Disease risk.

In the list below, if a percentage is listed in parentheses, this refers to the Lancet Commission Report estimating the percent reduction in dementia occurrence if this risk factor is eliminated.

(1) Cardiovascular Disease: Cardiovascular disease risk factors put people at greater risk for reduced cognitive function and dementia later in life. Cardiovascular disease could just as easily be called cerebrovascular disease.

(2) Stress: Zero stress is not the goal. That is a purposeless life. Hitting the "sweet spot of stress" involves allowing enough stress into your life to give you purpose, meaning, and direction for your energies and efforts while avoiding getting locked into a pattern of chronic stress that will tear down both your brain and your body. Successful stress mitigation during periods of unavoidable or higher stress is the key.

(3) Sleep: Poor quality and/or inadequate sleep quantity reduces the time that the brain spends cleaning up after itself. The topic of sleep will get an expanded treatment later in the text.

(4) Obesity (1%): With deleterious effects for every organ and every bodily system, obesity unsurprisingly increases the likelihood of dementia.

(5) Diabetes (1%): When blood sugar gets too high, the sugar sticks to cells, disrupting proper cellular function and this wreaks havoc throughout the body. With a brain keenly dependent on efficiently using a large amount of fuel, diabetes is potentially disastrous for brain health.

This is also another way to understand how powerful physical activity can be in managing blood sugar and maintaining brain health. Resting muscles remove no sugar from the bloodstream, but contracting muscles remove sugar rapidly from the bloodstream and can do so without requiring insulin.

(6) Depression (4%) – depression typically features low-BDNF, less social interaction, poor nutrition, and decreased physical activity so it's relationship to dementia is strong.

(7) Smoking (5%) – It is interesting how during the Covid-19 pandemic of 2020, when society decided to do "whatever it takes to save lives," cigarettes remain legal.

(8) Traumatic Brain Injury – Falling is the most common cause of TBI. According to the U.S. Centers for Disease Control, 36 million people 65 and over experience a fall annually. TBI need not occur when older to contribute to dementia as TBI at any age is considered a risk factor.

(9) Hearing Loss (8%): By itself, hearing loss will greatly decrease both cognitive stimulation opportunities and social interaction. (Note that it is the highest percentage risk factor for dementia of the ones assigned a percentage by the Lancet Commission Report.)

(10) Peripheral Vision Loss – Areas of the brain that control peripheral vision deteriorate early in AD. (Javaid, 2016)

(11) Social Isolation (2%): Social connection is to our spirit like oxygen is to our lungs. Most of humanity became the subject of an unplanned experiment on the effect of social isolation during the Covid-19 pandemic of 2020. The "results" of this study showed incontrovertibly that social isolation degrades mental health in general and engenders or accelerates cognitive decline specifically. People with extant dementia or MCI experienced rapidly worsening symptoms.

Meta-analyses have identified that social isolation is both a primary and secondary risk factor for increased mortality risk and that the type of social interaction was meaningful with closer, more complex relationships showing a more positive effect than simply living in proximity to other people.

(12) Gut bacteria/microbiome: Dementia risk is increased by harmful bacteria in your colon. The gut of people with Alzheimer's disease exhibits a distribution of bacteria that looks much like someone with obesity or type-2 diabetes. The brain and gut are mutually influential of each other and improvement of the gut microbiome for neuroprotection is a rapidly growing area of research. Gut bacteria eat what we eat and if we feed the type of bacteria that cause inflammation, we increase our risk for dementia.

(13) Education (Cognitive Reserve) (7%): this concept states that the more learning you accumulate, the more you build up a cognitive reserve so that if cognitive decline happens, you are subtracting from a higher amount of cognitive ability, delaying the onset of symptoms. People with more education have lower prevalence of dementia, more years of cognitively healthy life, and fewer years with dementia, and a meta-analysis of studies found robust support for the cognitive reserve hypothesis.

(14) Hypertension (2%)

(15) Nutrition – we are made of what we eat. Pro/Anti-inflammatory diet is highly correlated with Alzheimer's disease

(16) Exercise and Physical Activity (Physical Inactivity 2%): These would most helpfully be considered as two separate categories: "Dedicated exercise," which would be physical activity done at a high enough intensity to create a stimulus for change; and "Incidental physical activity," which would be physical activity from housework, walking the dog, etc., which would be done much more frequently than dedicated exercise.

(17) Excessive Alcohol Consumption (1%) – defined as greater than 21 units/servings per week by the Lancet Commission Report.

(18) Air Pollution and Exposure to Secondhand Smoke (2%) – where we live, work and workout determines what we breathe and take into our bodies.

What Current Research Says: Dementia May Be Preventable

It is by now obvious that Alzheimer's and most dementias are heavily multi-factorial and cannot be avoided by a single lifestyle factor nor treated successfully with a single drug. It takes a large cluster of behaviors and interventions to improve chances of a favorable outcome.

Multiple modes of behavior change have a more powerfully positive effect than single mode lifestyle interventions. We must combine efforts on anything from the above list which is modifiable rather than pick a single behavior to modify and expect to see measurable improvement in existing disease or to aid in prevention.

"Prevention" is likely too strong of a word to responsibly use and should perhaps be better thought of as "risk reduction" since there are no guarantees of absolute prevention. As our understanding of Alzheimer's disease expands and our approach becomes more refined, the future holds the opportunity to realistically expect legitimate prevention strategies.

Nevertheless, emerging research is providing valuable insights as to which modifiable behaviors work to reduce or increase risk of dementia.

The FINGER trial is the first randomized controlled trial showing that it is possible to prevent cognitive decline using a multi-domain lifestyle intervention among older at-risk individuals. For two years, over 2,600 people in Finland between age 60-77 participated in this study which used the following lifestyle interventions: diet, exercise (including both strength and aerobic training), cognitive training, and vascular risk monitoring. The results showed that the interventions improve or maintain cognitive functioning in at-risk elderly people.

In a massive study of over 300,000 people aged 50-73 years who were monitored for eight years to see who did and did not develop dementia, six healthy lifestyle behaviors were tracked:

- Eating a healthy diet with more fruits and vegetables, and less processed meat and refined grains
- Meeting physical activity guidelines of 150 or more minutes a week of moderate-to- vigorous physical activity
- Sleeping 6 to 9 hours each day
- Drinking alcohol in moderation
- Not smoking
- Not having obesity, meaning they had a BMI (body mass index) of under 30

The results showed that adopting healthy lifestyle behaviors can lower dementia risk even among people who are at higher risk due to a family history of dementia. Following all six healthy lifestyle behaviors cut the risk of dementia by almost half and following three of the healthy behaviors was associated with a 30% reduced risk compared to following two or less healthy behaviors, even when investigators considered familial dementia and accounted for related risk factors for dementia like age, race, sex, education, hypertension, Type-2 diabetes, and depression.

Everywhere you look in the research community, you find clear evidence of the above modifiable risk factors relating to dementia. Our brains are a particularly sensitive part of our bodies. As many of the above risk factors put all organs and bodily systems at risk, protecting our brain is done by doing what protects our bodies, and vice versa. This is welcome – if unflashy – news.

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The Best News Yet

Most of the preventive strategies for Alzheimer's fall directly under the scope of practice of fitness pros and health coaches: physical activity/exercise, social interaction, stress, sleep, and nutrition. The details of the rest of these are covered in the Alzheimer's Fitness Specialist Course. Here are the practical applications to physical activity and exercise to prevent and improve Alzheimer's.

In a practical sense, the following specific elements are how we integrate cognitive and physical fitness:

Explicit Cognitive Challenge – while performing physical activity or an exercise, mentally recite alphabet skipping every other letter; count up/down to/from 100 by threes or sevens, count the number of various objects you see or things you hear.

Reactivity – sensory input produces motor output

- Visual – see something and then do something
- Auditory – hear something and then do something
- Kinesthetic – feel something and then do something

Coordination – all exercise or movement uses coordination. The right amount of coordination challenge is when you can mostly perform well with perhaps occasional mistakes.

Novelty – the right amount is essential. Insufficient novelty leads to boredom and disengagement while too much novelty leads to feeling overwhelmed and demotivated.

Partner Interactivity – social connection during physical activity. Video is good if it is the only option, but live and in person is preferred as our brains know the difference – and respond differently – to a video interaction versus an in-person one.
One study shows clearly that activities involving moving and socializing can enhance brain function. Sedentary people in their 60s and 70s who were sedentary at the start of the study were tested on aerobic fitness, memory, and processing speed and put into distinct activity groups: brisk walking, gentle stretching/balance, and dancing. After six months, the dancing group had the biggest improvement in processing speed and memory.

An important aspect of partner interactivity is physical touch. We need it for healthy development as babies and for continued healthy mental function as adults. Babies deprived of touch experience all manner of developmental deficiencies. As adults, touch lowers cortisol and can reduce stress, heart rate, and blood pressure.

Appropriate and comfortable touch during exercise is yet another layer of brain health benefit potentially added if used effectively. An additional side effect of the social isolation of the pandemic of 2020 was the revelation of the unequivocal role that physical touch plays in mental health and is also another feature of the human experience that is diminished with Alzheimer's. High-fives, hugs, and handshakes must always be part of the human experience and misguided efforts to remove them are once again altering social norms to be misaligned with what is optimal for humans – as we have already done for sleep, nutrition, physical activity, and other domains.

Friendly Competition – typically enhances effort automatically and adds an enjoyable element to physical activity. Some people like to compete to win *against* others while others derive enjoyment from competing *with* others. For the latter group, competition is more about collaboration than domination.

Interestingly, competition positively influences exercise intensity and leads to greater performance, even in people who identify as non-competitive. Groups of people were tested in competitive and non-competitive situations and in general all individuals – regardless of competitive preference – performed better.

Why do we want to combine the above strategies with physical activity?
Because it is better. Physical activity is good – adding these elements simultaneously makes it better.

Exercise Demonstrations…

The Alzheimer's Fitness Specialist Course goes into detail on the lifestyle factors that are most modifiable and how to modify them and includes:

- Over 11 hours of video
- Nearly 100 exercise videos
- 200+ page manual with expanded information
- Interviews from people whose loved ones died from and are living with the disease as well as people who have used strategies from the course to avoid it.