

# Promoting Brain Health through Lifestyle and Nutrition

Kelly H Cuetara MS RD LDN

MD-DHCC Spring Workshop

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# Objectives

- Identify the risk factors for cognitive decline
- Identify biological markers of cognitive health
- Define neural reserve & neuroplasticity, how they protect against cognitive decline & how to increase them
- Explain lifestyle factors promoting brain health
- Identify essential nutrients, nutrition interventions and role of diet in maintaining brain health

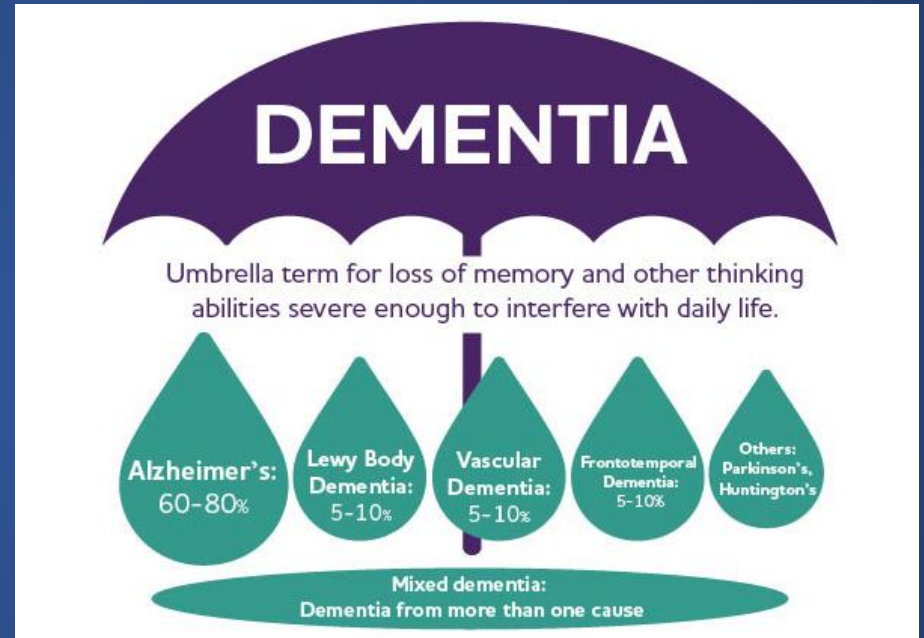
# Statistics

- More than 6M with Alzheimer's
- 6<sup>th</sup> leading cause of death.
- Deaths from A/D ↑ by 16% during pandemic
- 2021 Cost \$355 billion
- 2050 Costs could ↑ to \$1.1 Trillion
- 11 M Americans provide unpaid care
- Minorities discriminated against when seeking healthcare up to 50%

<https://www.alz.org/alzheimers-dementia/facts>

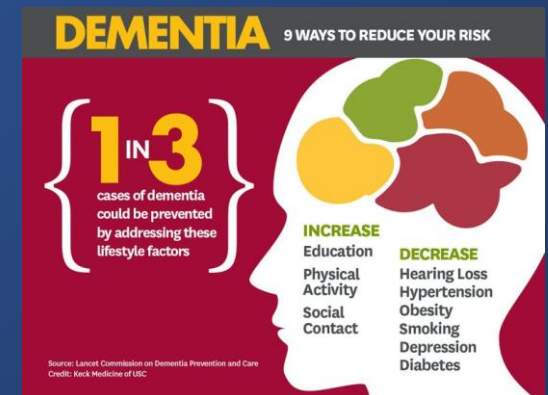
# Different Types of Dementia

- Alzheimer's
- Lewy Body
- Vascular
- Dementia associated w/  
nutrient deficiencies
- Frontotemporal
- MCI



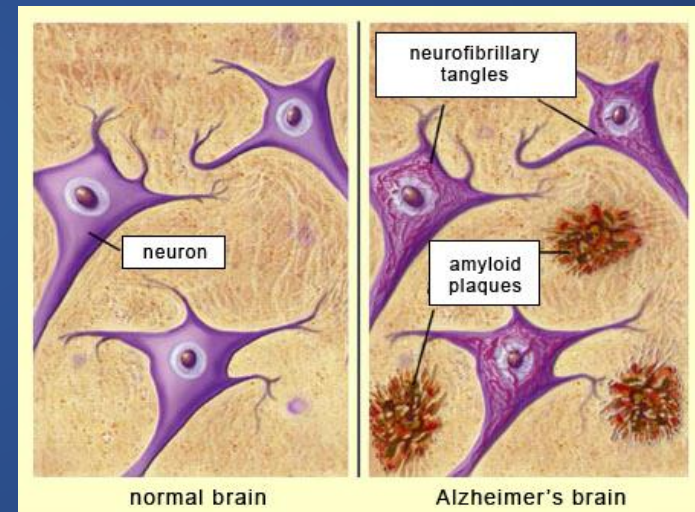
# Risk Factors for Dementia

- CVD Risk Factors– Obesity, HTN, HLD, DM
- Smoking & ETOH
- AD → Type III DM – variant of Alzheimer’s gene APOE4 interrupts how the brain process insulin, found in ~20% gen pop and ~50% of Alzheimer’s
- Obesity –  $\uparrow$  insulin resistance, releases hormones & cytokines  $\rightarrow$  inflammation
- Lifestyle interventions more effective in reducing DM2 and obesity than medication
- Social Isolation & Depression
  - Social connections help to keep you connected, provide purpose



# Biological Markers of Dementia

- Dysfunction in synaptic transmission of neurons
- Amyloid plaques
- Neurofibrillary tangles
- APOE genes



# Tangles and Plaques

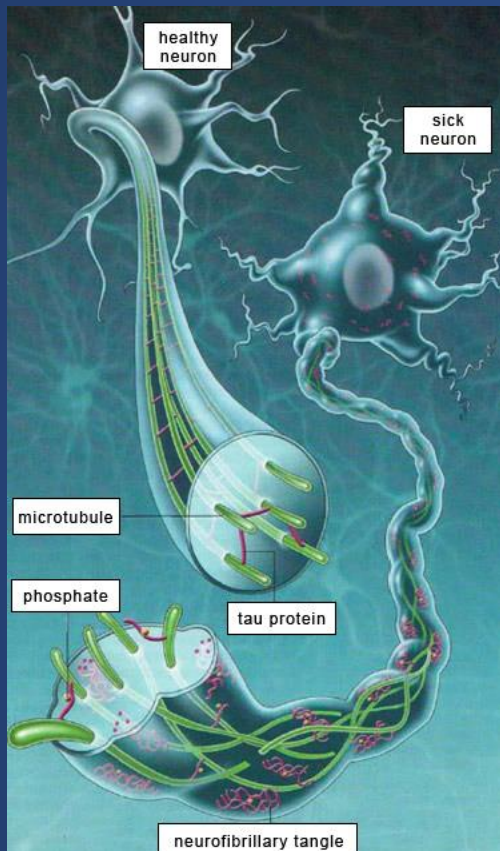


Figure 1  
[https://thebrain.mcgill.ca/flash/d/d\\_08/d\\_08\\_cl/d\\_08\\_cl\\_alz/d\\_08\\_cl\\_alz.html](https://thebrain.mcgill.ca/flash/d/d_08/d_08_cl/d_08_cl_alz/d_08_cl_alz.html)

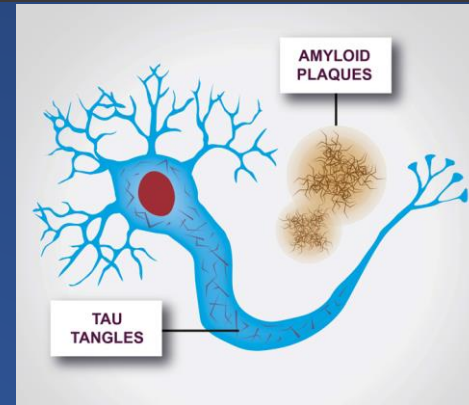
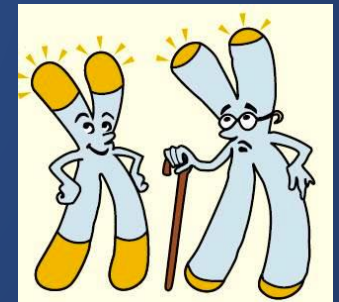


Figure 2  
<https://www.alzheimersresearchuk.org/blog/untangling-tau-in-the-brain/>

- Tau proteins are like tracks in the brain cells
- Amyloid plaques accumulate outside brain cells
- Help to both stabilize nerve cells in the brain and communication between cells
- Chemically altered they become damaged
- Hypoperfusion in vascular disease  
→ tangles and plaques buildup

# Telomeres and Dementia

- Shorter Telomere length  $\rightarrow$   $\downarrow$  life expectancy,  $\uparrow$  risk of chronic disease,  $\uparrow$  cellular senescence
- Two lifestyle factors positively impact telomere length
- Diet
  - Consumption of legumes, nuts, seaweed, whole grains, seafood, fruits & 100% fruit juice, dairy products, vegetables, total fiber, PUFAs and coffee.
  - $\downarrow$  TL length ETOH, red meat and processed meats, saturated fats, added sugar in sugar-sweetened beverages. SAD associated w/ negative impact on TL.
  - SAD  $\rightarrow$  inflammatory state  $\rightarrow$  progressive telomere attrition
  - Mediterranean diet antioxidant and anti-inflammatory effect
- Exercise

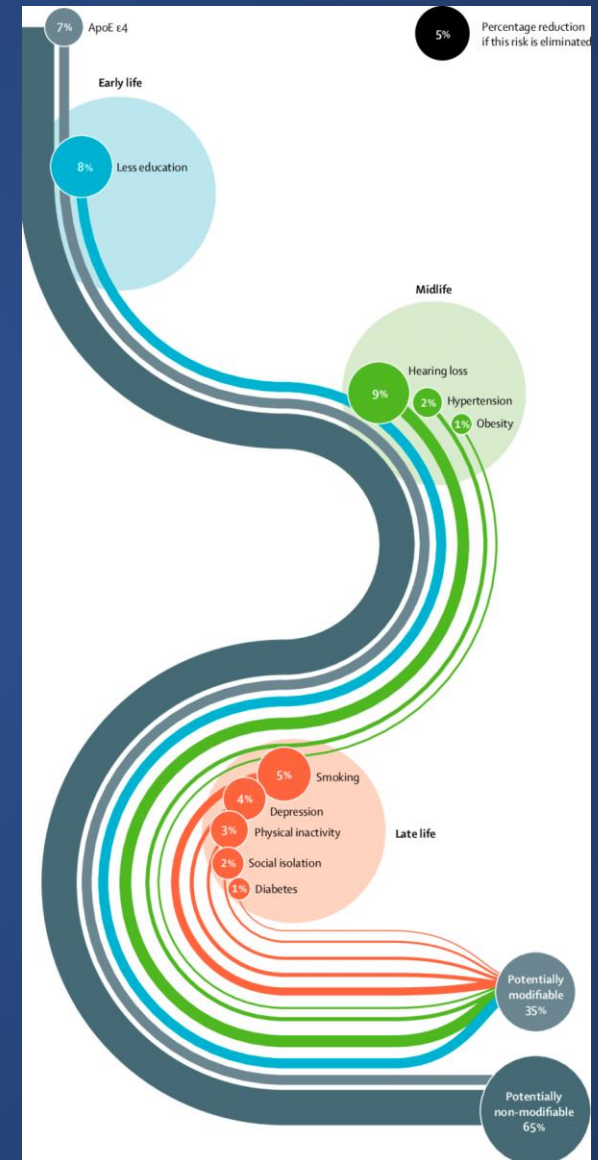


*Balan et al 2018, Koh, Seong-Ho et al, 2020, Hagg, S et al, 2017*



# Lifestyle & Risk Factors in Brain Health

• <b>Diet</b>	• <b>Obesity</b>
• <b>Exercise</b>	• <b>Hyperlipidemia</b>
• <b>Sleep</b>	• <b>Hypertension</b>
• <b>ETOH intake</b>	• <b>Diabetes</b>
• <b>Smoking</b>	• <b>Education</b>
• <b>Stress</b>	• <b>Head Injury</b>
• <b>Social</b>	• <b>Hearing Loss</b>
<b>Contact</b>	



# Lifestyle Factors to Promote Brain Health → EXERCISE

- Physical inactivity most significant risk factor in cognitive decline and development of dementia (Lancet Neurology 2011)
- Sitting ▶ new smoking – negative metabolic health
- Aerobic exercise → less shrinkage of brain, ↓ inflammation
- ↑ release of endorphins, improves self-esteem, sense of well-being
- ↑ circulation to the brain increasing production of BDNF hormone – Brain-Derived Neurotrophic factor (Gupta, 2021)
- Stress Reduction
- Blood Pressure control
- Weight Maintenance

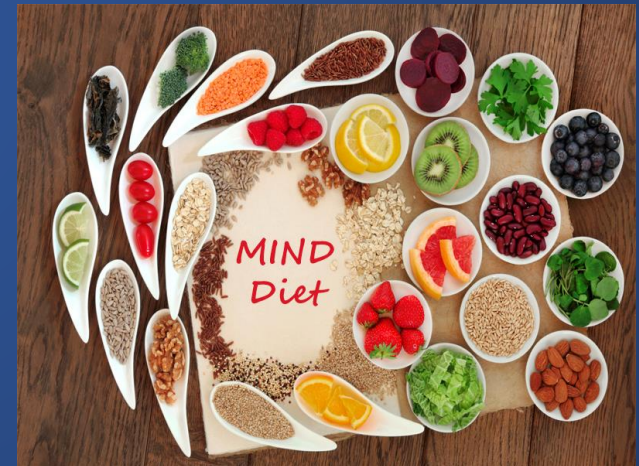
# Lifestyle Factors to Promote Brain Health → EXERCISE

- Aim for 30 minutes 5x a week or 150 minutes
- Maximum benefit from triple that or 64 minutes daily
- Purposeful aerobic and strength training
- Being more active throughout the day
- Walking



# Lifestyle Factors to Promote Brain Health → Nutrition

- Brain uses 20% of the calories we require
- The MIND Diet puts focus on plant-based foods linked to dementia prevention. The diet encourages eating from ten food groups:
  - Leafy green vegetables- at least 6 servings a week
  - Other vegetables- at least 1 serving a day
  - Berries- at least 2 servings per week
  - Whole grains- at least 3 servings per day
  - Fish- 1 serving per week
  - Poultry- 2 servings per week
  - Beans- 3 servings per week
  - Nuts- 5 servings per week
  - Olive oil
  - Wine – no more than one glass per day



# Nutrients for Brain Health

- **DHA omega-3 fatty acid in the neuronal membrane helps maintain normal structure and function**
- **N-3 PUFAs**
  - Fresh fish, flaxseed, canola oil, walnuts, chia, seaweed
- **Vitamin E neutralizes free-radical molecules**
- **B Vitamins** – Folic acid B<sub>9</sub>, Pyridoxine B<sub>6</sub>, Cobalamin B<sub>12</sub> → ↓ homocysteine
- **Vitamin D<sub>3</sub>** – extremely low levels associated w/ 2x risk of AD
  - Combats inflammation, fights oxidative stress, stimulates nerve growth factors
- **Cocoa Powder** – Flavanols (CocoaVia unsweetened dark chocolate)



# Nutrition and Brain Health - ABCs

- **A – Consume Regularly**

- Fresh Vegetables, leafy greens, whole berries, fish & seafood, healthy fats, Nuts & Seeds

- **B – Foods to Include**

- Beans & legumes, whole fruits, low sugar, lowfat dairy, poultry, whole grains

- **C – Foods to Limit**

- Fried Foods, pastries, sugary foods, processed foods, red meat & products, whole fat dairy, salt

Gupta, 2021 - The Global Council on Brain Health 2019 report “Brain Food: The GCGH Recommendations on Nourishing Your Brain”



# Lifestyle Factors → Lifelong Learning

- **Use it or lose it**
- **Cognitive reserve – pre-existing networks that are more efficient or have greater capacity are less susceptible to disruption**
- **Cognitive stimulation ↑ blood flow to brain, ↑ BDNF promoting survival of new neurons in the hippocampus & synaptic growth**
- **Enhanced when combined with social interaction & physical activity**
- **Increases grey matter volume in the frontal, parietal & temporal lobes**

# Lifestyle Factors → Lifelong Learning

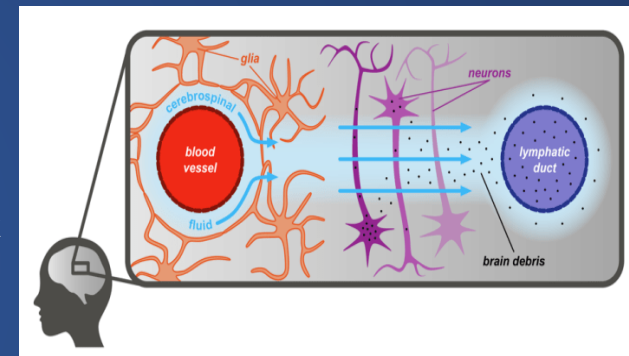
- Games & puzzles ↑ working memory
- Memorization - ↑ size of hippocampus
- Converting less memorable items (list) to images
- Taking a class
- Learning a 2<sup>nd</sup> language or a new skill
- Speed training
- Video based brain training
- British Taxi Drivers
- Johns Hopkins Experience Corps 1988
- Bicycling, joining a group, planning group's activities





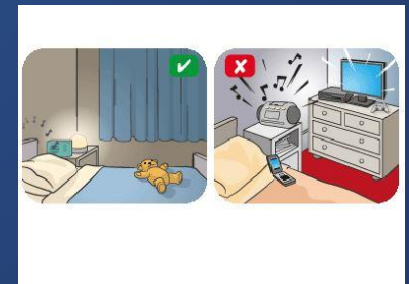
# Lifestyle Factors to Promote Brain Health → SLEEP

- **Deep sleep – restorative.** Brief bursts of brain activity called **sleep spindles** move recent memories from **ST space** in **hippocampus** to the **neocortex**. Hippocampus able take in new information
- **Fewer than 6 hours**
  - 29% greater risk of a major coronary event
  - 44% increased risk of pre-DM developing into DM; 5 hours → 68% risk
- **Rinse Cycle – Glymphatic Cycle**
- **Toxins and abnormal proteins that form Alzheimer's plaques are cleared away during sleep**
- **Fragmented sleep increases development of amyloid plaques which sparks inflammation, builds up tau proteins**
- **Ageing results in tissues lining our airways to sag → sleep apnea → O<sub>2</sub> deprivation leads to neuronal cell death**



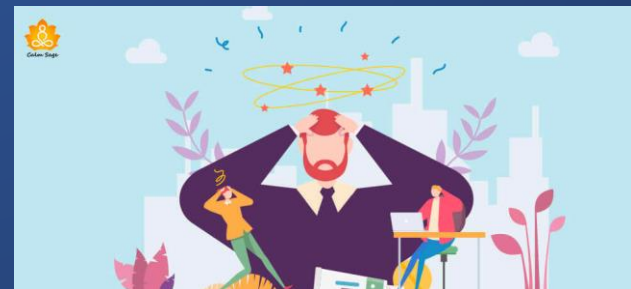
# Lifestyle Factors to Promote Brain Health → SLEEP

- 7-8 hours of sleep
- Avoid long naps
- Stick to a schedule
- Non-REM dominates in early part of the night. Slow-wave more restorative and deeper
- Dream-rich REM closer to dawn – lack of dreaming indicator
- Sunlight in AM to set body clock and circadian rhythm
- Exercise
- Avoid caffeine after noon, avoid eating 2-3 hours before bed
- Cool, quiet and dark
- Bedtime rituals



# Lifestyle Factors to Promote Brain Health → STRESS

- **Chronic stress leads to elevated levels of cortisol**
- **Negatively impacts diet, mood, exercise, relationships, sleep patterns**
- **Causes neuronal stem cells to inhibit connections to the prefrontal cortex where learning and memory occur**
- **Blood Sugar Imbalance & Diabetes**
- **Weight Gain**
- **Immune System Suppression**



# Lifestyle Factors to Promote Brain Health → STRESS

- Aerobic exercise  $\downarrow$  stress hormones adrenaline & cortisol;  $\uparrow$  endorphins. Distracts from worry, clears the mind.
- Autoregulation Exercises or Mind-body Practices – yoga, tai chi, qigong, gardening, walking, dancing, Pilates, deep breathing, meditation, Progressive Muscle Relaxation



# Literature Review

## Meta-Analysis of Forty-two studies

- 3781 healthy older adults ages 55+ were analyzed. 1966-2010.
- Interventions generally took place in laboratories, gymnasium facilities, in the home and outdoors. Testing was administered by experimenters.
- Aerobic interventions produce neurogenesis in animal models and increased hippocampal volume in young and middle-aged adults as well as older ones.

*Shoshana B Hindin, Elizabeth M Zelinski 2012*

## Religious Orders Study & Rush Memory & Aging Project Community Based Cohort Study

- Religious – started 1994, over 1200 enrolled, f/u 95% & 90% autopsy rate
- Older Lay persons – started 1997, over 1500 enrolled, f/u 90% autopsy rate 80%
- Mixed pathologies more common cause of dementia;
- ↓ co-morbidities → ↓AD diagnosed
- Association of loneliness w/ clinical AD independent of AD pathology
- Social networks mediate effect on cognition through ASCVD
- MIND diet score found to be a better predictor of cognitive decline than either MD or DASH

*Bennett, David et al. 2013*

# Literature Review

## **Intermittent metabolic switching, neuroplasticity and brain health**

- Study on the effects of transitioning from utilization of CHO and Glu to FA and ketones as cellular fuel source (G to K switch) which can happen w/ fasting or after exercise which accelerates the depletion of liver glycogen stores
- Improves neural connections in hippocampus
- Increases BDNF – protein that protects & strengthens neural connections and synaptic growth
- Neurons respond to the G to K switch engaging in cell-preservation mode and cell-growth mode.
- Upregulates neurotrophic factor which promotes mitochondrial biogenesis and cell growth and plasticity during recovery.

*Mattson, Mark P et al. 2018*

# Literature Review

## **Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) study – Contemporary Clinical Trial**

- 604 overweight participants between 65-84 at risk for dementia
- 3 year MIND dietary counseling intervention + mild caloric restriction for weight loss vs usual diet + caloric restriction
- Cognitive function at baseline w/ MRI at beginning & end of study
- Primary end point is change in global cognitive score measured by battery of tests
- Cognitive domains – EF, perceptual speed, episodic memory and semantic memory
- Changes in total brain volume & hippocampal volume
- Other measures of brain macro- & micro- structural integrity including white and gray matter, lesions and thickness of cortical regions

*Liu, Xiaroran, et al. Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) study*

# Literature Review

## FINGER

- Double-blind randomized controlled trial
- Participants ages 60-77 w/ inclusion criteria Cardiovascular Risk Factors, Aging & Dementia
- Cognitive performance at mean or slightly < mean average for age
- 2-year multi-domain study
- 1260 participants
- Cognitive assessment w/ standard neuropsychologic tests (extended version of neuropsychological test battery or NTB) administered baseline, 12 & 24 months.
- All – regular health advice, feedback on metabolic and vascular risk factors, monitored BP, weight, BMI, hip & waist circumference. Met w/ RN & MD, written and oral information on diet, physical, cognitive & social activities.
- Intervention group extended info on diet, physical, cognitive & social activities
- Outcomes:
  - Simultaneous changes in several risk factors → leads to protective effects on primary outcomes (overall cognition), secondary outcomes (EF, PSI) → 25%-150% better in intervention group than control
  - No significant effect on memory but positive effect on more complex memory tasks.
  - Decreased risk of cognitive decline

*Ngandu, Tiiia et al. “2015.*



# Literature Review

## Mind diet and Subjective Memory Complaints

- Prospective association study of 6011 participants  $\geq 60$  years w/o SMC at start
- Web-based observational cohort launched in 2009 in France
- Goal to investigate the prospective association between adherence to the MIND diet and SMC
- SMC associated w/ age, represents changes in memory
- SMC early marker of subsequent cognitive decline, possible precursor of MCI & AD
- MIND diet score found to be a better predictor of cognitive decline than either MD or DASH in Rush Memory & Aging project
- Results
  - Adherence to the MIND diet inversely associated w/ SMC among older adults 70+ over mean f/u of 6 years.
  - Better verbal memory score, better cognitive function, slower decline in cognitive abilities and lower risk of AD
  - Highest quintile of MD score vs lowest quintile associated w/ 36% lower odds of poor subjective cognitive function and 24% lower odds of a moderate subjective cognitive function
  - Mind Score comprised of 21 nutrition components including macro and micro nutrients

*Adijibade M et al 2019.*

# Lifestyle Balance

- **Avoid extremes – don't eliminate a food group**
- **Maintain healthy weight**
- **Keep moving**
- **Obtain quality and adequate sleep**
- **Manage stress**
- **Maintain a social network**
- **Limit ETOH**
- **Avoid smoking**
- **Keep Learning**



# References

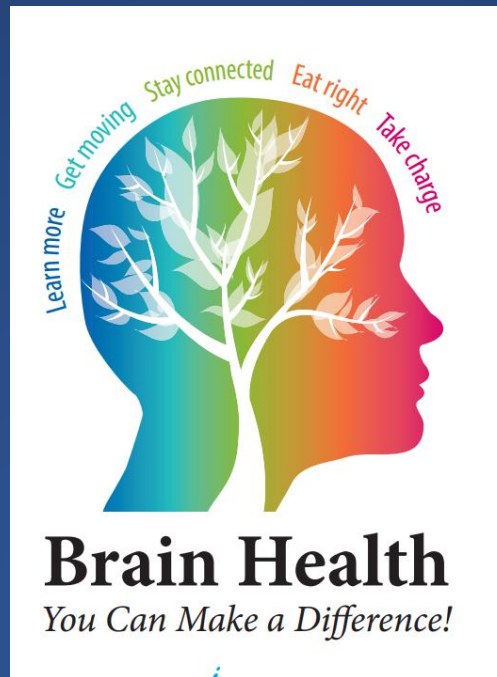
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Thank you!  
Any Questions?