PREVENTIVE NEUROLOGY & BRAIN HEALTH REFERENCE

Alzheimer's Disease: Prevention & Risk Reduction

Modifiable Lifespan Risk Factors, Cardiometabolic Protection, Sleep Clearance, and Cognitive Reserve

Can Alzheimer's disease be prevented? While age, family history, and genetic risk alleles (such as *APOE ε4*) cannot be changed, landmark epidemiological research—including the Lancet Commission on Dementia Prevention—demonstrates that addressing **14 modifiable risk factors across the lifespan can prevent or delay up to 45% of dementia cases**. Because amyloid-beta and tau pathology accumulate silently 15 to 20 years before memory symptoms begin, proactive brain-protective habits in midlife and beyond substantially lower clinical risk.

> **Core Brain-Health Principle:** "What protects the heart protects the brain." Preserving cerebral blood flow, controlling vascular inflammation, clearing metabolic waste during deep sleep, and building dense synaptic networks (cognitive reserve) allow the brain to resist and compensate for age-related pathology.

1. Cardiometabolic & Vascular Risk Control

Cerebrovascular disease accelerates Alzheimer's pathology and lowers the threshold at which amyloid and tau cause cognitive decline.

Modifiable Target	Neurobiological Mechanism	Actionable Prevention Strategy
Midlife Hypertension	Chronic high blood pressure damages cerebral microvessels, impairs blood-brain barrier integrity, and causes white-matter lesions.	Maintain systolic blood pressure **<120–130 mmHg** from age 40 onward through regular monitoring, sodium reduction, exercise, and antihypertensive therapy when indicated.
LDL Cholesterol & Lipids	Elevated midlife LDL cholesterol promotes cerebral atherosclerosis and accelerates amyloid-beta deposition.	Screen lipid panels regularly in midlife; manage elevated LDL via heart-healthy fats, soluble fiber, and clinician-guided lipid-lowering therapy.
Insulin Resistance & Type 2 Diabetes	Impaired brain insulin signaling (sometimes termed "Type 3 diabetes") disrupts neuronal energy metabolism and tau clearance.	Prevent or tightly control prediabetes and Type 2 diabetes through glycemic balance, regular resistance/aerobic exercise, and healthy midlife weight.
Smoking & Excess Alcohol	Tobacco causes oxidative vascular injury; heavy alcohol intake (>14–21 units/week) causes direct neurotoxicity and brain atrophy.	Quit smoking completely at any age (which rapidly restores risk toward baseline) and limit alcohol intake to minimal or light levels.

2. Physical Activity, Neuroprotective Nutrition & Sleep

Daily lifestyle habits directly stimulate neuroplasticity, reduce neuroinflammation, and clear neurotoxic proteins from brain tissue.

- **Aerobic & Resistance Exercise:** Engaging in at least **150 minutes per week** of moderate aerobic exercise (brisk walking, cycling, swimming) plus twice-weekly strength training increases cerebral blood flow and stimulates **Brain-Derived Neurotrophic Factor (BDNF)**, growing hippocampal volume and lowering Alzheimer's risk by up to 30–40%.
- **The MIND & Mediterranean Dietary Patterns:** The **MIND diet** (Mediterranean-DASH Intervention for Neurodegenerative Delay) emphasizes leafy green vegetables (≥6 servings/week), berries (especially blueberries and strawberries), nuts, extra-virgin olive oil, whole grains, beans, and fatty fish rich in DHA/EPA omega-3s while limiting red meat, butter, pastries, and ultra-processed foods.
- **Restorative Sleep & Glymphatic Clearance:** During deep slow-wave sleep, the brain's **glymphatic system** expands interstitial channels to flush out soluble amyloid-beta and metabolic waste. Aim for 7–8 hours of quality sleep nightly and evaluate/treat **obstructive sleep apnea (OSA)** promptly, as nocturnal hypoxia markedly increases dementia risk.

3. Sensory Health, Cognitive Reserve & Environmental Protection

Keeping the brain actively stimulated and protected from sensory deprivation, head trauma, and environmental neurotoxins preserves functional resilience.

- **Correcting Hearing & Vision Loss Early:** Untreated midlife hearing loss is one of the largest population-level modifiable risk factors for dementia because it increases cognitive load and drives social withdrawal; using **hearing aids** and correcting cataracts or refractive vision loss significantly reduces cognitive decline.
- **Building Lifelong Cognitive & Social Reserve:** Mentally demanding activities—learning a new language or musical instrument, complex strategy games, continuing education, and active social connection—build redundant neural synapses that buffer against cognitive symptoms, while treating depression protects hippocampal health.
- **Preventing Traumatic Brain Injury (TBI) & Air Pollution Exposure:** Wear helmets during cycling or contact sports, prevent falls in older adulthood, and use indoor HEPA air filtration during high-pollution or wildfire events to reduce fine particulate ($PM_{2.5}$) neuroinflammation.
- **Routine Adult Vaccinations:** Emerging population studies indicate that staying up to date on routine adult vaccines—including annual influenza, shingles (herpes zoster), and pneumococcal vaccines—is associated with lower dementia incidence by reducing severe systemic neuroinflammatory insults.