Brain Healthy Lifestyle: Much More Than Brain Games

James M. Ellison MD MPH
Swank Foundation Endowed Chair in Memory Care and Geriatrics
Swank Memory Care Center and Christiana Care Health System

Brian A. Dahlben, MSc
Sidney Kimmel Medical College at Thomas Jefferson University

Brain Training in the News

Recent research threatens to cast a pall on public enthusiasm for the “Brain Games” claimed to keep our brains healthy and our minds supple. In a noteworthy review, lead author Daniel Simons of the University of Illinois at Urbana-Champaign analyzed the findings of more than 130 original research studies on brain games. Simons and his colleagues offered a comprehensive and very thoughtful synthesis of available evidence. Their conclusion is that we do not have enough evidence to prove that brain games help cognition significantly or prevent dementia.¹ Does this mean we should abandon Brain Games? And, more importantly, what do these findings say about the preventability of cognitive decline? I’m going to discuss the bigger picture of a “brain healthy lifestyle” and put brain games into that broader context.

Why Should We Worry About Dementia?

Loss of cognitive function is one of the greatest fears of aging adults, and for good reason. In the US and around the world, the number of people whose lives are affected by Alzheimer’s Disease and other dementias continues to climb in parallel with our aging population. By 2050, Alzheimer’s Disease will affect an estimated 106.2 million people worldwide.² As the most prevalent dementia in the US, Alzheimer’s Disease is our sixth leading cause of death,³ affecting a third of people who have reached or passed age 85.⁴ These somber statistics, however, are only one measure of the suffering imposed by a disease that can undermine quality of life, stress caregivers, and impose huge financial burdens for many years before it ends a life.

What Are Our Current Treatment Options?

At present, our standard approach to treating dementia is reactive rather than proactive. Once a family becomes concerned and seeks help, a clinician must determine whether cognitive symptoms are interfering with a person’s independence before assigning a diagnosis of dementia. Various tests serve to narrow down the diagnostic possibilities and make sure that reversible conditions are addressed. Then, a variety of resources are enlisted to help the patient and care system cope with what will be a progressively debilitating disease. Geriatric care managers may help to coordinate lifestyle and care elements. Social supports including peer groups and caregiver groups are available through the Alzheimer’s Association and elsewhere. Senior centers and adult day care programs provide activities such as social groups, activities, and exercise classes. Elder law specialists can facilitate a family’s legal and financial planning for the future. Ultimately, labor intensive care at home or the protective
environment of institutional care may become necessary to assure safety and adequate support.

Like psychosocial resources, our current medical treatments are reactive in nature. The so-called cognitive enhancers, cholinesterase inhibitors and memantine, are approved for use once a diagnosis of mild to severe Alzheimer’s Disease has been made. Their benefits are regarded as significant enough to warrant their use. Their effectiveness, though, is limited and too often accompanied by side effects. Ultimately they do not change the course of dementia’s progression.

Disease-modifying medications may become available in the future, but for now they remain a work in progress. More effective medical interventions for Alzheimer’s Disease are well worth pursuing, and hundreds of clinical trials are doing just that. Human monoclonal antibodies, in particular, have held out the hope of slowing the destructive effects of Alzheimer’s Disease. The latest research in *Nature, for example,* shows preliminary evidence supporting aducanumab as effective for both clearing Aβ plaques and improving clinical decline. While we await a medical breakthrough, however, we can take considerable hope from research that promotes the value of a more proactive and preventive approach. A growing body of research addresses the promotion of “wellness” and clarifies the role that lifestyle factors play in promoting or delaying cognitive decline. The value of a preventive approach is underscored by findings from biomarker studies that show the clinical appearance of dementia to be preceded by two or three decades of metabolic change that may provide opportunities for intervention.

**Lifestyle Factors Affect Brain Health**

Identification of risk factors for cognitive decline has fueled interest in a preventive strategy often referred to as the “brain healthy lifestyle”. Such a lifestyle includes attention to the management of diseases such as hypertension or diabetes mellitus, promotion of physical activity and cognitive stimulation, improvement of nutrition, encouragement of social engagement, and optimization of stress management and restorative sleep.

A recent population-based analysis estimated that about one third of the risk for Alzheimer’s disease is attributable to lifestyle factors. Data from the United States link the largest proportion of this risk with physical inactivity. Inactivity is defined as less than the recommended level of physical activity, 20 minutes of vigorous activity on 3 or more days per week or moderate activity for 30 minutes on 5 or more days per week. Other important Alzheimer’s risk factors include diabetes mellitus, midlife hypertension, midlife obesity, and depression. Physical inactivity is both a contributor to and a potential consequence of these other conditions.

Physical exercise, which improves many aspects of health, appears to have significant cognitive benefits as well. Meta-analysis of multiple controlled exercise studies supports claims of improved attention processing speed in cognitively normal older adults. Furthermore, exercise improves cognitive functioning in older adults with established memory complaints and can even promote symptomatic and functional improvement in people already diagnosed with dementia.

**Where Do Brain Games Fit In?**
“Brain Games”, despite the vigor with which they have been marketed, are neither the most important nor the sole component of the brain healthy lifestyle. Lumosity, BrainHQ, Cogmed, Cognifit, Vigorous Mind -- these and other companies are major figures in a multi-billion dollar industry providing brain training tools to consumers eager to preserve optimal cognitive functioning in later years.\textsuperscript{11} Brain games are frequently promoted on TV, internet, and radio, including NPR programs which listeners experience as highly credible. The value of cognitive stimulation or brain training, however, has been inconsistently supported by research. Simons and colleagues’ review points out the reasons for scientific doubt about their true value.

Much of the scientific concern about brain games has focused on two features that should characterize a successful tool for cognitive training: persistence and generalizability. In the famous ACTIVE study, a mere 10 sessions of cognitive training appeared to confer some benefits in instrumental activities of daily living a decade later.\textsuperscript{12} Other studies, however, have questioned whether gains demonstrated after cognitive exercises will endure over time. Generalizability, on the other hand, refers to the translation of benefits gained while practicing one task to the performance of other cognitively-demanding tasks. If I can remember a sequence of food orders placed in a video game exercise, for example, will this improve my ability to find my car in the sprawling parking lot at the mall? Task-specific improvement is a recognized benefit of brain games, but evidence of generalizability has been limited and inconsistent.\textsuperscript{1}

An additional and valid concern about brain games was raised in 2015 by a group of neuroscientists from Stanford University and Germany’s Max Planck Institute. In a consensus statement regarding cognitive stimulation, these scientists pointed out the limitations of current data and noted that time spent on computerized exercises also imposes an “opportunity cost”.\textsuperscript{13} In other words, the time spent on computer games is time NOT spent with other people, or exercising the body, or pursuing an enjoyed hobby. For some people, time spent in those other ways will be a more valuable investment than time spent with challenging puzzles or games.

**Brain Games Are Only “Part of a Healthy Brain Lifestyle”**

Large, objective, well-designed studies are currently assessing the effects on cognitive aging of combined preventive interventions. Not surprisingly, the results from these multi-modal protocols look more impressive than those obtained from studies in which brain training was the only intervention. Among the completed experiments, my favorite is the one known as FINGER. It is a study of multi-modal prevention in a Finnish geriatric population. In the FINGER study, more than one thousand adults, ages 60 to 77, were assigned either to a control group receiving only health advice or to a multi-modal intervention that included management of vascular risk factors, physical activity, nutrition, cognitive stimulation, and social engagement.\textsuperscript{14} Two years later, this healthy lifestyle group showed significantly less cognitive impairment as compared to the control group.

Other studies continue to look at cognitive and other benefits of multi-modal preventive strategies. In the study known as preDIVA, which has focused on prevention of vascular dementia, participants were evaluated for cardiovascular and cognitive functioning. Those found to have vascular risk factors were started on medication and counseled regarding a
healthy lifestyle. After 6 to 7 years of follow up, however, the rates of dementia in the control and experimental groups were similar.\textsuperscript{15} Further evaluation of the data from this study, including analysis of the nutrition and physical activity in each group, may shed light on this negative result. The MAPT study, a 3-year-long intervention incorporating changes in nutrition, exercise, and cognitive activity,\textsuperscript{16} has not yet published its findings.

Anticipating stronger evidence of the cognitive benefits of a brain healthy lifestyle, medical centers around the United States have begun to offer Brain Gyms, Brain Fitness Centers, Brain Boot Camps, and other programs employing preventive and multi-modal strategies to foster optimal cognitive aging. UCLA’s Longevity Center’s programs include a 1-day Brain Boot Camp as well as longer-term Brain Gym and Memory Maintenance programs.\textsuperscript{17} In Boston, the Beth Israel Deaconess Hospital’s Brain Fit Club combines transcranial magnetic stimulation with groups for Tai Chi, meditation, nutrition and sleep education, and cognitive stimulation.\textsuperscript{18} The University of Santa Barbara’s Cottage Center for Brain Fitness hosts a program that adds telehealth communication and coaching.\textsuperscript{19} At Penn Memory Center’s Cognitive Fitness Program, attendees can access group instruction, relaxation training, and guided use of cognitive stimulation software.\textsuperscript{20} As these programs gather outcomes data, we are on the verge of learning more about which approaches yield the most beneficial outcomes.

\textbf{Hope for the Future}

In the battle against Alzheimer’s Disease and other dementias, early intervention will remain of critical importance even if disease-modifying treatments become available. New tools for earlier detection may improve risk assessment and diagnostic accuracy even during the pre-symptomatic phase of the disease. At this time, a focus on wellness-oriented preventive strategies holds the greatest promise for reducing the disease burden of Alzheimer’s Disease and most likely other dementias as well. Cognitive stimulation of some kind may well contribute to an overall good outcome, but our current best evidence is casting a brighter light on other health-improving tools such as medical disease management, physical activity, healthful nutrition, restorative sleep, stress management, and social engagement. Earlier identification of at-risk individuals and encouragement of these wellness strategies give us hope for diminishing the personal and social burdens of Alzheimer’s Disease until a definitive cure is found.

\textbf{Citations}


