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_____ _____

Ann Elisabeth Vandenberg Date

What We Can Say about Cognition in Aging:
Arguments for and against Cognitive Health Promotion

By

Ann Elisabeth Vandenberg
Doctor of Philosophy

Graduate Institute of the Liberal Arts

_____
Sander L. Gilman
Advisor

_____
Ellen Idler
Committee Member

_____
Claire E. Sterk
Committee Member

Accepted:

_____
Lisa A. Tedesco, Ph.D. Dean of the James T. Laney School of Graduate Studies

_____ Date

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By

Ann Elisabeth Vandenberg
M.A., York University, 2005

Advisor: Sander L. Gilman, Ph.D.

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Abstract

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By Ann Elisabeth Vandenberg

Rising life expectancies and reductions in chronic disease mortality have resulted in an increasing prevalence of cognitive impairment in the United States, with high societal and personal costs, widespread fear, and a thriving marketplace of cognitive solutions that have not received official sanction. Cognitive health in aging has therefore emerged as a pressing public health issue. However, the intersection of gerontology, cognition, and public health has received little academic attention to date. This qualitative research project examines the question, *Why have no public health recommendations been issued nationally for older Americans to maintain or promote their cognitive health?* and the deeper epistemological question, *What is adequate evidence for issuing public health recommendations*? or *When do we know enough to act*? Using a grounded theory framework, it examines discourse by cognitive health experts and published documents in three areas of cognitive health activity: research, industry, and policy. Altogether, 17 experts were interviewed and a sequence of policy arguments traced from the Cognitive and Emotional Health Project, to the Alzheimer's Association's Maintain Your Brain™ campaign, to the CDC-based Healthy Brain Initiative, to the NIH State-of-the-Science Conference on Preventing Alzheimer's Disease and Cognitive Decline, to the National Alzheimer's Project Act. After evaluating epidemiology and randomized controlled trials (RCTs) on lifestyle behaviors for cognitive health, it examines arguments made for or against issuing public health recommendations, using the Toulmin model of analyzing arguments. The analysis revealed four epistemological arguments for or against recommending public health recommendations for cognitive health: 1) the *Evidence-Based Policy Argument*, which uses RCTs alone to warrant issuing recommendations, 2) the *Epidemiologically Informed Policy Argument*, which proposes that epidemiology and RCTs together constitute adequate evidence, 3) the *Triangulated Evidence Policy Argument*, built around a cumulative weight of multiple forms of evidence to support recommendations, and 4) the *Logically Derived Policy Argument*, which uses RCTs showing that a behavior is effective in preventing a risk factor for a certain disease to endorse the same behavior to prevent a common cognitive sequela of that disease. This project ultimately endorses the *Logically Derived Policy Argument* in support of heart-healthy behaviors for cognitive health.

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To my parents and their parents

What We Can Say about Cognitive Health in Aging:
Arguments for and against Cognitive Health Promotion

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Introduction

This qualitative research project addresses the question *Why have no public health recommendations been issued nationally for older Americans to maintain or promote their cognitive health?* The obvious answer to this question is that evidence for recommendations is inconclusive, but underneath this answer lie deeper questions about how evidence for public health should be evaluated for action. In this dissertation I examine recent discourse around cognitive health promotion policy in the United States, attempting to lay out a range of arguments for and against issuing public health recommendations for cognitive health. It is hoped that the endeavor will focus the dialogue on policy options and contribute to the field of public health gerontology.

In April 2010 Dr. Jennifer Crossman from the Office of Medical Applications Research provided an introduction to the National Institutes of Health (NIH) State-of-the-Science Conference on Preventing Alzheimer's Disease and Cognitive Decline, at which a large and attentive audience of scientists and other interested parties was assembled. She recounted Dr. Leon Gordis's insight into the "shoving and shouting in the aisles" that followed the issuance of a 1997

State-of-the-Science Conference statement *not* recommending breast cancer screening for women in their forties. As though expecting a similar reaction to this conference's as-yet unwritten statement, she repeated Gordis's message that the State-of-the-Science Conferences were designed not to steer decisions made at an individual or family level, where a few individuals might be affected, or even those made at the level of a medical practice, where at most a couple hundred patients might be affected. Instead, they were aimed at decision making for an entire population of people. At this level, it was essential to make sure "that we step back from our own personal opinions and values and that we're using the strength of the evidence to drive the decision, and the strength of the evidence alone. And the rationale for that is because if we're wrong in that case, we have the potential to negatively impact millions of people."[1] As Crossman indicated, the stakes in evaluating evidence at the conference were high.

Although the State-of-the-Science Conference was framed around cognitive decline and Alzheimer's disease, one of the six research questions that it evaluated evidence for was "*What are the therapeutic and adverse effects of interventions to improve or maintain cognitive ability or function?*," a question closely related to public health promotion for cognitive health. At the Conference's closing, an independent panel of health professionals and public representatives issued a statement that "firm conclusions cannot be drawn about the association of *any modifiable risk factor* with cognitive decline or

[1] U.S. Department of Health & Human Services, "NIH State-of-the-Science Conference: Preventing Alzheimer's Disease and Cognitive Decline – Day 1," NIH VideoCasting and Podcasting, CIT File ID: 15839, 3:33, http://videocast.nih.gov/launch.asp?15839 (accessed November 7, 2012).

Alzheimer's disease."[2] Regarding the question about interventions to improve or maintain cognitive health, it stated that "Despite some encouraging associations found in observational studies, RCTs [i.e., randomized controlled trials] of specific interventions have not *definitively* established positive therapeutic effects on maintaining or improving cognitive function, or preventing cognitive decline." The statement provides an immediate answer to our own research question, *Why have no public health recommendations been issued nationally for older Americans to maintain or promote their cognitive health?* One reason there have been no recommendations is because the State-of-the-Science Conference panel did not find definitive randomized controlled trials showing that any modifiable behavior maintained or improved cognitive health.

As Crossman had foreshadowed, the statement drew emotional responses during the meeting and later in the media and in the public commons, as well as among some cognitive aging experts who expressed disappointment and frustration at the reading of the evidence. Negative reactions to the conference from researchers included that it was "very negative," "very unhelpful," and that "there was a lot of disenchantment with the NIH report."[3] Other experts stood by the statement as a judicious message about the state of the science to date, as "very accurate."[4]

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[2] U.S. Department of Health & Human Services, "NIH State-of-the-Science Conference: Preventing Alzheimer's Disease and Cognitive Decline – Day 3," NIH VideoCasting and Podcasting, CIT File ID: 15855, 2:01, http://videocast.nih.gov/launch.asp?15855. Emphasis mine.

[3] Peter Rabins, interview by author, Baltimore, MD, August 11, 2011; Peter Whitehouse, interview by author, telephone, September 19, 2011; George Rebok, interview by author, Baltimore, MD, August 11, 2011, respectively.

[4] Jennifer Manley, interview by author, New York, NY, October 11, 2011.

The State-of-the-Science Conference Statement challenged programs devoted to promoting cognitive health in older adults. For example, in 2005 Congress had established the Healthy Brain Initiative (HBI) within the Healthy Aging Program (HAP) at the Centers for Disease Control and Prevention (CDC) in partnership with the Alzheimer's Association to "address cognitive health with a focus on lifestyle issues."[5] The Healthy Brain Initiative appeared to represent something new by articulating a health perspective, referencing the positive outcome of maintaining cognitive health. It is not clear why the State-of-the-Science Conference on Alzheimer's disease and Cognitive Decline had included a health promotion question among disease-focused research questions. Investigating the same evidence for functional health outcomes as for clinically defined outcomes does not necessarily give the topic of healthy cognition its due. Sanctioning the panel's answer to the question may have had a strong impact on health promotion research efforts.

Following the release of the State-of-the-Science Conference Statement, HAP Director Lynda Anderson noted that "to pursue this whole thing of lifestyle interventions when NIH and our federal colleagues would be opposed to it didn't make sense."[6] After the Conference the HBI emphasized other efforts, such as surveillance of the public health burden of cognitive impairment, a process that usually precedes and justifies a community-based public health focus. As Anderson described the aftermath of the Statement, alluding to the program's $1.6 million annual budget and the need for additional research, "CDC doesn't

[5] Centers for Disease Control and Prevention and the Alzheimer's Association, *The Healthy Brain Initiative: A National Public Health Road Map to Maintaining Cognitive Health*. (Chicago, IL: Alzheimer's Association, 2007), 8.

[6] Lynda Anderson, interview with author, Atlanta, GA, November 21, 2011.

have the money to do clinical trials but NIH does...and they are starting to do some of those pieces. It's going to take longer. That's just the nature of how things are. So we can't act upon it [healthy brain research]. Until those interventions get published...there's not much that CDC can do to disseminate them."[7] Chief Medical and Scientific Officer of the Alzheimer's Association William Thies, who had supported a "brain health movement" at the Association, critiqued the statement as "a very nihilistic view [that] in fact has been very damaging to brain health initiatives.... when our guys go to Washington and say you know we really need to put more money into brain health initiatives, the response is NIH ran a conference and said you can't do it, so why should we waste money on it."[8]

One could view the roles of the NIH and the CDC hierarchically, as a scientific organization determining an objective truth which must be translated by the intermediary CDC into a message for the American public. Technically the NIH and the CDC are both located within the Public Health Service, but whereas the NIH sets the national health research agenda for the United States and is closely affiliated with scientists, the CDC among other duties delivers messages to the public on what to do to be healthy and is closely affiliated with the majority of state public health departments across the country. However in the case of the Conference, the NIH-supported State-of-the-Science Statement seemed to issue its own public health message directed at "millions of people." Conference Panel Chair Martha Daviglus even published a commentary in *The Los Angeles Times*

[7] Ibid.
[8] William Thies, interview with author, Chicago, IL, December 5, 2011.

with a consumer protection stance: “Headlines have trumpeted such things as doing crossword puzzles, taking vitamin supplements, exercise and even drinking more red wine as possible ways of averting Alzheimer's disease and other kinds of dementia. But so far, there's no proof that any of them works.” She recommends, among other things, that people “avoid spending money on products with little or no proven benefit.”[9]

The effect of the State-of-the-Science Conference findings on cognitive health promotion raises a deeper question about the epistemology of health promotion efforts within public health: How do we determine the truth in order to act? The conference projected a firm positivistic perspective, with Croswell insisting that “opinions and values” had no place in its conclusions. One must ask whether an epistemology governing the natural sciences (e.g., biology, neuroscience) and medicine should be the same as that governing community intervention efforts (public health). Communities are recipients of evidence-based messages, but they also issuers of health related concerns, fears, questions, and theories of their own. In issuing a message, public health is presumably also answering to other messages that come from the public that in turn come from messages the public receives from the media, the marketplace, and other sources. The HBI acknowledged this “push-pull” of science and marketplace in its central document, as will be discussed further in chapters 1 and 4.[10]

The social context surrounding population-based health efforts is inevitably shaped by “opinions and values.” For example, the desire for cognitive

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[9] Martha Daviglus, “Making Sense of Dementia; Vitamins, Exercise, Red wine--None Is Proved to Stave off Mental Decline,” *Los Angeles Times*, May 25, 2010.

[10] CDC & AA, *Road Map*, 24.

health and the fear of cognitive decline are not necessarily expressed in every culture. Indeed, what is meant by cognitive health and decline? Within the mainstream U.S., are cognitive health and decline defined as the presence or absence of amyloid plaques and tangles? As the presence or absence of brain infarcts? As certain brain volumes, dendritic densities, or perfusion levels? As the ability or inability to get a particular score on neuropsychological tests? As the ability or inability to manage one's finances or to live independently? Throughout the story of the emergence of cognitive health in aging as a public health issue to the crossroads where it stands today, "cognitive health" has never had a single neutral agreed-upon definition.

To understand the full impact of and reaction to the State-of-the-Science Conference Statement, one must also consider the biopsychosocial context around cognitive health in the U.S. today. Improved living conditions helped in the control of infectious diseases and facilitated the epidemiological transition, a shift in the balance of prevalence from infectious and acute diseases to chronic conditions.[11] Infant and child mortality rates plummeted in western developed countries, and the average life expectancy in the U.S. rose from 48 years in 1900 to 73 years in 1980[12] and to almost 79 years today.[13] As populations have aged they have accumulated a greater prevalence of neurodegenerative diseases such

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[11] Abdel R. Omran, "The Epidemiologic Transition: A Theory of the Epidemiology of Population Change," *Milbank Quarterly* 49, no. 4 (1971):509-538.

[12] Fries, James, "Aging, Natural Death, and the Compression of Morbidity." *The New England Journal of Medicine* 303, no. 3 (1980): 130-135.

[13] The exact life expectancy reported was 78.9. Sherry L. Murphy, Jiaquan Xu, Kenneth D. Kochanek, "Deaths: Preliminary Data for 2010," *National Vital Statistics Report* 60, no. 4 (2012): 1-51.

as those linked to dementia.[14] Moreover, the brain ages as does the rest of the body.[15] A conservatively estimated 36% of Americans age 71 and older, or 8.8 million people, have some degree of cognitive impairment, according to functional assessments, and 14%, or 3.4 million, have full-blown dementia.[16] As more people live to higher ages and comprise a larger portion of the population, the prevalence of cognitive impairment is expected to expand; using the rate of 36%, about 18 million Americans age 70 and up will be cognitively impaired by 2030.[17]

The effects of dementia are not confined to patients. A 2001 estimate put the cost of informal (non-institutionalized) care alone at $18 billion annually.[18] It is three times as costly for Medicare to care for someone with dementia than for

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[14] Kiyotaro Kondo, "Rising Prevalence of Neurodegenerative Diseases Worldwide," *Internal Medicine* 35, no. 4 (1996): 238.

[15] Timothy A. Salthouse, "Selective Review of Cognitive Aging," *Journal of the International Neuropsychological Society* 16, no. 5 (2010): 754-60.

[16] The actual prevalence figures were 31.1% for cognitive impairment and 13.9% for dementia only, in 2002. The data is from the Aging, Demographics, and Memory Study. These estimates use both cognitive measures (the Mini-Mental State Exam) and functional measures (the Dementia Severity Rating Scale and the Clinical Dementia Rating) to estimate cognitive impairment among both communities and long-term care facilities. B.L. Plassman, K.M. Langa, G.G. Fisher, S.G. Heeringa, D.R. Weir, M.B. Ofstedal, J.R. Burke, M.D. Hurd, G.G. Potter, W.L. Rodgers, D.C. Steffens, R.J. Willis, R.B. Wallace, "Prevalence of Dementia in the United States: The Aging, Demographics, and Memory Study," *Neuroepidemiology* 29, no. 1-2 (2007): 125-32.; Brenda L. Plassman, Kenneth M. Langa, Gwenith G. Fisher, Steven G. Heeringa, David R. Weir, Mary Beth Ofstedal, James R. Burke, Michael D. Hurd, Guy G. Potter, Willard L. Rodgers, David C. Steffens, John J. McArdle, Robert J. Willis, and Robert B. Wallace, "Prevalence of Cognitive Impairment without Dementia in the United States," *Annals of Internal Medicine* 148, no. 6 (2008):427-434.

[17] Numbers obtained from "Table 2. Projections of the Population by Age, Sex, Race, and Hispanic Origin for the United States," 80. Jennifer Cheeseman Day, *Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050*, U.S. Bureau of the Census Current Population Reports P25-1130 (Washington, DC: U.S. Government Printing Office, 1996), http://www.census.gov/prod/1/pop/p25-1130.pdf (accessed October 31, 2012).

[18] Kenneth M. Langa, Michael E. Chernew, Mohammed U. Kabeto, A. Regula Hertzog, Mary Beth Ofstedal, Robert J. Willis, Robert B. Wallace, Lisa M. Mucha, Walter L. Straus, A. Mark Fendrick, "National Estimates of the Quantity and Cost of Informal Caregiving for the Elderly with Dementia," *Journal of General Internal Medicine* 16, no. 11 (2001): 770-8.

someone of the same age without dementia.[19] Caregivers often experience worsening health conditions, reporting fatigue, pain, depression, stress, and weight gain.[20] In addition, although its prevalence is not as high as other chronic conditions such as cardiovascular disease, dementia seems to evoke a disproportionate amount of fear among the general population. A PARADE/Research! America poll of one thousand Americans over the age of 17 found that 62% feared losing their mental capacity compared with 29% who feared losing their physical capacity.[21] A MetLife Foundation poll of 1000 Americans over the age of 41 found that 20% of respondents specifically feared Alzheimer's disease more than cancer, heart disease, stroke, or diabetes.[22]

Dementia is culturally salient. Aging Americans are confronted with tragic images or stories of famous people with dementias. In addition, in recent years, it seems that cultural works have increasingly turned to the subject of dementia. Two films, *Iris* about the author Iris Murdoch and *Away from Her*, have raised awareness of what dementia in a spouse does to a marriage. The film *The Savages* raises questions about how baby boomers will care for demented parents. Lisa Genova's recent best-selling novel *Still Alice* depicted the harrowing breakdown of a mind from the rare perspective of the person with dementia. If

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[19] Julie P. W. Bynum, Peter V. Rabins, Wendy Weller, Marlene Niefeld, Gerard F. Anderson, and Albert W. Wu, "The Relationship between a Dementia Diagnosis, Chronic Illness, Medicare Expenditures, and Hospital Use," *JAGS* 52 (2004): 187-194.

[20] National Alliance for Caregiving and Evercare. *Evercare Study of Caregivers in Decline: A Close-Up Look at the Health Risks of Caring for a Loved One: Report of Findings September 2006*, National Alliance for Caregiving, www.caregiving.org/data/Caregivers%20in%20Decline%20Study-FINAL-lowres.pdf (accessed September 11, 2012).

[21] See Lynda A. Anderson, Kristine L. Day, Renée L. Beard, Peter S. Reed, and Bei Wu, "The Public's Perceptions about Cognitive Health and Alzheimer's Disease among the U.S. Population: A National Review," *The Gerontologist* 49, no. S1 (2009):S3-S11.

[22] Ibid.

popular culture is an indicator of public concern, dementia is a preoccupation of contemporary society.

Fear is insidious. A survey of people aged 40-60 and found that 35.5% of them looked for dementia in themselves in one or more ways, such as repeatedly checking for symptoms of dementia, assuming that perceived cognitive changes are dementia, or asking for confirmation of perceived symptoms from others. This type of symptom seeking has been called "anticipatory dementia."[23] I believe that lack of clear distinctions between the constructs of age-related cognitive change, more serious cognitive decline or impairment without dementia, and dementia itself fuel a free floating anxiety in which the "normal" and "pathological" vie as potential self diagnoses. The authors of a well-known family resource for Alzheimer's caregivers acknowledge that "[i]n many cases the initial changes in mental ability are ... subtle and difficult to pin down. Then how does one know when forgetfulness or lapses in judgment become serious enough to require professional attention? The answer is that there is simply no clear line marking the boundary between normal and abnormal mental ability. The border is a zone rather than a line...."[24] It has even been argued that Americans have a particular fear of dementia because of the value that we place on autonomy, so that "senility haunts the landscape of the self-made man."[25] Cognitive

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[23] See Stephan J. Cutler and Lynne Gershensen Hodgson, "Anticipatory Dementia: A Link between Memory Appraisal and Concerns about Developing Alzheimer's Disease," *The Gerontologist* 36, no. 5 (1996):657-664.

[24] Donna Cohen and Carl Eisdorfer, *The Loss of Self: A Family Resource for the Care of Alzheimer's Disease and Related Disorders (Revised Edition) (*New York: W. W. Norton & Company, 2001), 41.

[25] Jesse Ballenger, *Self, Senility, and Alzheimer's Disease in Modern America: A History* (Baltimore: Johns Hopkins University Press, 2006), 153.

impairment is a major risk factor for institutionalization,[26] which in turn can entail loss of independence, financial difficulty, and social isolation.

Considering this wider psychosocial context, there appears to be an urgent need for advice on what to do to maintain cognitive health. The media seem happy to oblige in this respect. In fact, an unbridgeable gulf appears to lie between a constant stream of published advice on what to do to keep one's brain healthy, on the one hand, and the State-of-the-Science Statement that nothing has been proven to maintain or improve cognitive function, on the other. The urgency remains unanswered and the stream of media advice goes unabated. Within the context of the demographic imperative (almost 20% of Americans will be over the age of 65 by the year 2030), expected rising prevalence of dementia, and pervasive fear of dementia, the answer to the question *Why have no public health recommendations been issued nationally for older Americans to maintain or promote their cognitive health?* is only partially answered by the State-of-the-Science Conference Statement. The wider issue really is, *What is adequate evidence for issuing public health recommendations?* or *When do we know enough to act?* Several possible answers to these epistemological questions emerge from the documents and interview transcripts analyzed for this project.

The first viewpoint, expressed in the State-of-the-Science Conference Statement, is that of evidence-based medicine and evidence-based practice. The approach endorses the randomized controlled trial (RCT) as the level of evidence needed to establish truth. Only by randomly and blindly assigning interventions

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[26] Melanie Luppa, Tobias Luck, Siegfried Weyerer, Hans-Helmut Konig, Elmar Brahler, Steffi G. Riedel-Heller, "Prediction of Institutionalization in the Elderly," *Age and Ageing* 39, no.1 (2010): 31–38.

against a control group who do not engage in the intervention can those interventions be tested for efficacy. An assumption behind this viewpoint is that only the detailed "truth" can be disseminated to the public. I call this the *Evidence-Based Policy Argument*.

The second viewpoint is that less rigorous observational evidence will suffice in certain circumstances for establishing behavioral recommendations. Although generally regarded as less conclusive than RCTs, observational studies include prospective longitudinal designs with representative samples that attempt to causally link exposures or behaviors earlier in life with health outcomes later in life. Another approach is to study homogeneous populations (such as an order of nuns) in order to control for and thereby rule out confounding factors such as socioeconomic status or diets.[27] According to the second argument type, an abundance of such associations may constitute enough proof for issuing public health messages, especially when a situation is time sensitive, RCTs are prohibitively expensive, and interventions (such as preventing someone from exercising) would be unethical. The advice given does not necessarily have to be at a detailed, prescriptive level. I call this *Epidemiologically Informed Policy Argument.*

A third viewpoint is a combination of the preceding two. In this case, it is the combination and cumulative weight of evidence that can be used to recommend behavior change. In addition to RCTs and epidemiological evidence,

[27] A good example of this is the so-called Nun Study by epidemiologist David Snowdon. See the lay tradebook: David Snowdon, *Aging with Grace: What the Nun Study Teaches Us about Living Longer, Healthier, and More Meaningful Lives* (New York: Bantam Books, 2001).

one might add quasi-experimental data, formative research, and narrative. I call this the *Triangulated Evidence Policy Argument*.

A last viewpoint is a different way of combining the first and second arguments. In this case, RCTs showing that a particular lifestyle behavior is effective in preventing a risk factor for a certain disease can be used to argue that the same behavior can prevent a common cognitive sequela of that disease. For example, evidence linking heart disease risk with cognitive impairment suggests that behaviors that reduce the incidence of heart disease will reduce the incidence of cognitive impairment. According to this viewpoint, evidence combined with logic make a strong enough case to provide recommendations, although research may need to be continued to establish the parameters of these recommendations. With this approach, the Multiple Risk Factors Intervention Trial that provided strong evidence for a low cholesterol diet, no smoking, and exercise to reduce risk of cardiovascular disease[28] might support the recommendation to exercise to reduce the risk of dementia in a population. Those who use this perspective often refer to "common sense" (putting two and two together) in the absence of RCTs. I call this viewpoint the *Logically Derived Policy Argument*.

In a sense, the HBI set up a forum to evaluate the evidence to recommend lifestyle behavior change for cognitive health to a public health infrastructure. It gathered multidisciplinary nationally known experts at an initial research meeting on translating science to public health practice, formed multidisciplinary expert work groups in the areas of Prevention Research, Surveillance, Policy, and

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[28] Jeremiah Stamler and James D. Neaton, "The Multiple Risk Factor Intervention Trial (MRFIT)—Importance Then and Now," *JAMA* 300, no. 11(2008): 1343-5.

Communication to work out the public health agenda, and created expert teams to evaluate evidence on subsequent research projects. This inclusive approach in the years 2006-2008 was very positively depicted by participants as a productive multidisciplinary dialogue that furthered a wider conversation on cognitive health at a national level within public health.[29]

The 2010 State-of-the-Science Conference was another kind of forum which in part evaluated the evidence for lifestyle behavior change for cognitive health. It included commissioning a systematic literature review,[30] holding a two-day conference of presentations by researchers with input from the public, and, through an independent panel of health professionals and public representatives, issuing a final statement that synthesized the data. I will analyze the discourse from both the HBI and the State-of-the-Science Conference in Chapter 4 The Evolution of Cognitive Health Policy.

My project represents a third examination of the evidence for lifestyle behavior change for cognitive health from the perspective of a public health gerontologist and the vantage point following the 2010 State-of-the-Science Conference. Like the other two examinations, I look at expert-level evidence.

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[29] This viewpoint was articulated well by participant Peter Rabins, interview with author, Baltimore, MD, August 11, 2001: "I thought the process itself was really a great learning experience, for me. I think it was a very open group of people. There are a lot of people at the CDC level, I think, who hadn't thought a lot about cognition and aging and dementia, and I think there are a lot of people in dementia and aging that hadn't thought a lot about the public health issues, how do you engage people in thinking about these issues. I think at that level it was very fruitful and really an open experience. I don't think many people came in with a closed mind on either side.... I think to me the biggest positive really was that it brought the CDC and what I would call the prevention infrastructure into this conversation. It did really heighten awareness among people who are thinking about public health and prevention that this is an important area, that there's a lot of morbidity and cost associated with it."

[30] Duke Evidence-based Practice Center, *Preventing Alzheimer's Disease and Cognitive Decline: Evidence Report/Technology Assessment No. 193*, AHRQ Publication No. 10-E005 (Rockville, MD: Agency for Healthcare Research and Quality, 2010).

However, the evidence that I examine is not exactly the same as that examined by the HBI and the State-of-the-Science Conference. In addition to the research data itself, my evidence is the collection of arguments made for or against issuing public health recommendations based on extant evidence. Occasionally, as with the ACTIVE Trial, the Impact Trial, and the evidence for the vascular-cognitive connection, where it is a strong focal point of the discussion, I examine the evidence directly in order to illustrate the various interpretations of that evidence. These topics will be covered in Chapter 2 Researching Cognitive Health. But the focus of the investigation is on the filters, or arguments, through which the evidence is presented.

This dissertation examines both written and spoken discourse by purported cognitive health experts in three areas of cognitive health activity: research, policy, and industry. Research was well represented in the HBI and NIH examinations, and policy had a strong presence in the HBI's. I examined the research and policy literature and spoke to professionals in those fields. Industry was not included directly in either the HBI or the NIH investigation despite a very visible market force and a blending of brain fitness industry and research, and so I have added brain wellness industry professionals overtly to the discussion.

Table 1.1 illustrates how unusual the topic of healthy cognitive aging has been within gerontology. There were 252 articles with the term "cognition" and 890 articles with the term "cognitive" in the title or abstract of three prominent gerontology journals, *The Gerontologist* and *The Journals of Gerontology: Series A and B*, between 1961 and October 2012. This number constitutes about 13.6%

of the approximately 8370 articles published. However, even within gerontology the issue of cognitive or brain *health* has barely been covered at all, with coverage starting as recently as 2001. Cognitive research tends to be framed in terms of disease or decline.

In contrast, there were 12 article abstracts that included the word "cognition" and 88 articles with the word "cognitive" in the abstract between 1911 and October 2012 in the *American Journal of Public Health*, constituting only .3% of the approximately 33,150 articles published. These searches suggest that while cognition is an important issue within the field of gerontology, it goes virtually unmentioned within the field of public health, although public health does cover aging issues. Meanwhile the term "public health" was mentioned in only 86 gerontology abstracts, or only about 1% of the time. This project therefore examines a disciplinary intersection that has received little attention to date.

Using a grounded theory approach,[31] I interviewed active cognitive health experts in the United States and examined their arguments made for or against public health recommendations. These experts included some of the participants of both the HBI and the State-of-the-Science Conference (e.g., Indiana University geriatric psychiatrist Hugh Hendrie). During interviews I asked these experts to recommend other experts who informed public policy, using a snowball sampling method. For example, one HBI participant, Johns Hopkins University geriatric

[31] Barry G. Glaser and Anselm L. Strauss, *The Discovery of Grounded Theory: Strategies for Qualitative Research* (Chicago: Aldine Publishing Company, 1967).

Table 1.1. Occurrences of cognitive terminology in titles and/or abstracts of leading gerontology and public health journals*

Search term	*The Gerontologist* and *The Journals of Gerontology: Series A and B* from 1961 (abstract or title field)	*The American Journal of Public Health* from 1911 (abstract field)
Cognition	252 (1973)	12 (1993)
Cognitive	890 (1970)	88 (1975)
Cognitive function or cognitive functioning or functioning cognitively	261 (1987)	18 (1977)
Cognitive performance or perform cognitively	76 (1991)	4 (1977)
Age-related cognitive change	5 (1999)	0
Cognitive improvement, improve cognition, or improving cognition	2 (2003)	0
Maintain cognition, maintaining cognition, maintain cognitive, maintaining cognitive, or cognitive maintenance	4 (2009)	0
Healthy cognition or healthy cognitive	3 (2008)	0
Brain health or healthy brain	9 (2001)	0
Cognitive health or healthy cognition	17 (2009)	2 (2008)
Dementia	643 (1980)	16 (1983)
Alzheimer's or Alzheimer disease	355 (1981)	7 (1987)
Cognitive impairment or cognitively impaired	247 (1983)	21 (1989)
Cognitive decline or declining cognition	101 (1989)	2 (2008)
Mental health	253 (1961)	318 (1975)
Public health	86 (1995)	n.a.
Age or aged or aging	n.a.	2584 (1921)

*Notes: Search was conducted on October 22, 2012; Dates following article count indicate the first mention of the term in the title and/or abstract.

psychiatrist Peter Rabins recommended that I speak with a non-HBI participant, Case Western University neurologist Peter Whitehouse.

Occasionally I started a snowball myself such as with brain fitness company VibrantBrains founder Lisa Schoonerman, who lead me to market research company SharpBrains CEO Alvaro Fernandez. All of those interviewed and included in the analysis are briefly profiled in the **Appendix: Profiles of Cognitive Health Experts Interviewed**. In keeping with grounded theory research, the number of interviews was not set ahead of time but was determined to be complete when the same themes began to be repeated and "saturation" of argument themes was reached. In total, I conducted 17 interviews.

The project was reviewed by the Institutional Review Board Sociobehavioral Committee at Emory University and given exempt status. Nevertheless, I distributed a consent form that was signed by all interviewees indicating their voluntary participation of the project and their right to drop out at any time. The interviews were all conducted either in person or, where not possible, over the telephone. These interviews were usually one hour in length, but they ranged from 42 minutes to 2 hours and 21 minutes. I used a semi-structured protocol, with similar questions about the interviewee's work, their definitions of key terms related to cognitive health, their knowledge of the national cognitive health initiatives and events, and their assessment of evidence supporting for behavioral change for cognitive health. However, the conversations flowed according to unique points made by the interviewees, and points made influenced questions asked in subsequent interviews. The interviews were audio recorded and transcribed verbatim.

My project evolved over time, as is consistent with grounded theory research. Initially, I used the constant comparison method of analysis to map out common areas of understanding and areas of confusion and difference in the cognitive health discourse to understand how cognitive health was being characterized as a public health issue. As the interviews progressed, I was directed to documents that had a bearing on policy. These included research articles on the connection between vascular risk factors and dementia outcomes, a sequence of policy documents that initiated and moved the discussion forward, and marketing materials and research produced by the brain fitness industry. The document analysis informed subsequent interviews. Over time I perceived the story arc that the issue of cognitive health emerged and then retreated within public health between the years 2005 and 2011. Gradually I refined my research to focus on arguments for or against issuing behavioral health recommendations.

Distilling arguments presented a second constant comparison process, involving perceiving elements, sorting them, and combining them where possible. I used the Toulmin model of analyzing arguments to examine textual or spoken discourse on cognitive health.[32] Stephen Toulmin was a British-born philosopher who emphasized applied over theoretical logic. Toulmin stated that any serious assertion made could be tested for its justificatory argument. He established a four-part pattern of analysis. First, the analyst identifies the argument's central claim. In his example of a scientific argument, this central claim might be the prediction of when a lunar eclipse would occur after September 6, 1956. Second, the analyst identifies evidence in support of the claim (for example, "*Observed*

[32] Stephen Toulmin, *The Uses of Argument* (Cambridge: Cambridge University Press, 1958).

positions of sun, moon and earth up to 6 September 1956"). Third, the analyst articulates the "warrant," or rationale, that connects the evidence to the claim. In this example, the warrant is "*current laws of planetary dynamics*." Fourth, the analyst identifies the backing or evidence for the warrant. In this case, the backing for the warrant is determined to be the "*totality of experience on which the current laws are based up to 6 September 1956*."[33]

While the claim is explicit, the warrant is usually implicit and needs to be analyzed and articulated in order to be evaluated. In addition, Toulmin distinguished between warrant-using arguments, or those that rely on established rationales (as in the example given above), and warrant-establishing arguments, or those that try to put forth new explanations for why evidence supports a claim. Warrant-establishing arguments are often used in scientific papers. A warrant-establishing argument related to the eclipse prediction might be, hypothetically, one that proposes a new law of planetary dynamics on which to base its prediction. [34]

Toulmin saw arguments that address a particular problem and share the same type of evidence and conclusions as comprising a "field of argument." In his words, "If fields of argument are different, that is because they are addressed to different sorts of problems. A geometric argument serves us when the problem facing us is geometrical; a moral argument when the problem is moral; an argument with a predictive conclusion when a prediction is what we need to produce, and so on."[35] I take from these words that even if arguments come from

[33] Ibid., 184.
[34] Ibid.
[35] Ibid., 167.

different disciplines, they can be brought together into a dialogue known as a "field of argument" if they address the same problem, such as behavior that can maintain or improve cognitive health based on the evidence that can be warranted to support the claim. To take it even further, claims that are made addressing the same problem can be pressed for argument, and the resulting arguments will belong to the same field of argument. Toulmin likens the analysis of arguments to legal deliberations. Usually claims are under scrutiny but where the arguments are warrant-establishing, the warrant itself is "on trial."[36]

The assertions made by cognitive health experts can be analyzed according to argument. In order to do this, I felt it was necessary to select representative excerpts from important documents or interviews in order to capture the full array of arguments found. Using the Toulmin model, I lay out claims, evidence, warrants, and backing for each passage quoted that address whether public health recommendations can be made for cognitive health in older adults. For one argument, the *Evidence-Based Policy Argument*, the warrant is well established and the default rule (i.e., that randomized controlled trials are the only valid proof of the effectiveness of lifestyle behaviors for cognitive health). The rest of the arguments propose other warrants that challenge the established warrant, and these arguments are therefore warrant-establishing.

The main arguments made by these professionals can be distinguished by their epistemological warrants as described earlier. There were four altogether: 1) the *Evidence-Based Policy Argument*, 2) the *Epidemiologically Informed*

[36] See Ibid., 120, 135, for this discussion.

Policy Argument, 3) the *Triangulated Evidence Policy Argument*, and 4) the *Logically Derived Policy Argument*.

Given the urgency surrounding cognitive health in an aging American population and the constraints on doing RCTs on lifestyle behaviors with cognitive outcomes, this project ultimately endorses the Logically Derived Evidence warrant in support of heart-healthy behaviors for cognitive health. I believe that this argument represents the best compromise between cautious restraint needed before making recommendations based on scientific findings and proactive action needed to address forecasted population needs, demands, and costs. It seems to be the "lowest hanging fruit" among possible recommendations and one that can have great impact because it provides a second argument for behaviors that are still not often adopted by the public for health.

This project has a number of limitations. First, the three areas that I have chosen to analyze – research, policy, and industry – are not discrete entities. Researchers, for example, are sometimes policymakers and occasionally have industry interests. My division of interviews into these three categories, therefore, is somewhat arbitrary but was guided by the dominant professional role interviewees appear to play in the cognitive health effort. Second, I ended up with a collection of researchers that were predominantly associated with the fields of psychology, psychiatry, and neurology, as it was difficult to find cognitive aging experts in the field of public health and my attempts to contact community leaders failed. Also, snowball sampling can bias the sample to include a similar kind of informants. Additional interviews might have rounded out any

inadvertent disciplinary limitation had there been more time. Third, while a semi-structured protocol provides the flexibility to follow the uniqueness of a particular conversation it also sacrifices aspects of comparability that a standardized questionnaire affords. Fourth, in condensing interview transcripts into quotable passages for this manuscript, I had to sometimes omit important points made by interviewees on other topics, sometimes those most intimately connected with their own work. I tried to stay true to the original conversation without conveying a sense of a polished presentation piece while also presenting a coherent passage in the order in which it was spoken. The shortening of the interviews sacrificed much rich detail. It was difficult to judge how much to reduce and how much to retain of the original. In general, the interviews were uniformly fascinating and I wish that I had room to include more from them. I greatly appreciate the time and effort the interviewees put into them.

There are four chapters. **Chapter 1 The Emergence of the Healthy Older Brain** introduces a major national cognitive health effort within public health, the HBI, in the context from which it emerged. I argue that four emerging areas of professional practice inform the HBI: health promotion within public health, successful aging within gerontology, evidence-based practice within public health, and healthy cognitive aging within psychology and neuroscience. From these areas of professional practice emerge a range of perspectives that can be used to examine policy in public health gerontology.

Chapter 2 Researching Cognitive Health addresses arguments presented by researchers who are involved in cognitive health research projects or who have joined the cognitive health policy discussion because of their

professional roles at research universities. There are two areas of research that are referred to often in this field, research on cognitive engagement (the ACTIVE and IMPACT Trials) and research linking vascular health with cognitive health. In this chapter, I examine both areas of research along with the interviews with researchers.

Chapter 3 The Cognitive Health Marketplace addresses the cognitive health industry, a subject that has usually not been included alongside academic and policy discussions. I interviewed three people in the cognitive fitness industry, a former researcher who is now head of a large corporation, an entrepreneur who started a brain gym, and the CEO of a market research firm that monitors the industry. I also interviewed a former Alzheimer's disease advocate who now runs brain health programs to provide a different perspective and argument on brain health promotion in the private sector. I analyzed the interviews and marketing literature provided by these businesses for arguments relating to cognitive health promotion.

Last, **Chapter 4 The Evolution of Cognitive Health Policy** presents the story of the emergence and retreat of cognitive health in public health between 2005 and 2011. The interviews and the documents associated with the HBI and the State-of-the-Science Conference revealed a sequence of documented events that illustrate shifting arguments at the national policy level. These were, the Alzheimer's Association's Maintain Your Brain™ campaign, the congressional appropriation establishing the Healthy Brain Initiative, the Cognitive and Emotional Health Project literature review that was used by the HBI, *The Healthy Brain Initiative: A National Public Health Road Map to Maintaining*

Cognitive Health (the *Road Map*), the State-of-the-Science Conference statement, a *New York Times* op-ed by Sandra Day O'Connor, Stanley Prusiner, and Ken Dychtwald, and the National Alzheimer's Project Act. The arguments presented in these documents and their implications are analyzed in this chapter.

Finally, I would like to disclose that the topic of this project developed through my internship with the CDC's Healthy Aging Program, where the HBI is housed. Although most of my work there did not relate to the HBI, I was exposed to information about the HBI and I came to write one paper on the concept mapping process used in development of HBI *Road Map*.[37] Following my two years at the CDC, I continued to attend the meetings of the CDC-funded Healthy Aging Research Network (HAN) and have recently become a formal affiliate member of this group. Despite these affiliations, I have tried to keep neutrality throughout the research process, examining the issues from a distance, interviewing people with sharply different perspectives, and venturing into areas not addressed during any discussions at CDC. It is important to state that the analyses and interpretations contained in this project are entirely my own and do not reflect any views gained from the CDC, HAN, or any organizations with which I have been involved. Lastly, I see the cognitive health effort as courageous, cutting-edge, and complicated, and any critique here is offered constructively rather than to lay blame on any individual or organization involved in its evolution.

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[37] Lynda A. Anderson, Kristine L. Day, and Anna E. Vandenberg (2011). "Using a Concept Map as a Tool for Strategic Planning: The Healthy Brain Initiative," *Preventing Chronic Disease* 8, no. 5 (2011):A117, http://www.cdc.gov/pcd/issues/2011/sep/10_0255.htm (accessed November 8, 2012).

Chapter 1

The Emergence of the Healthy Older Brain

> *It's three agencies of government when I get there that are gone. Commerce, Education and the, uh, what's the third one there? Let's see...I would do away with the Education, Commerce, and let's see, I can't. The third one I can't. Sorry. Oops.*
>
> -- Texas Governor Rick Perry in the Republican Presidential Debate, November 9, 2011

Listening to presidential candidate Rick Perry forget one of the three agencies he would cut if elected president of the United States (the Department of Energy), one had to wonder. What happened? Was Perry nervous? Tired? Could he have been drinking? Doubt grew during the multiple televised replays. How could any candidate forget his campaign platform? Was Perry losing it? As was painfully evident during the primaries, memory gaffes in prominent people of middle age are treacherous if they even so much as hint of a slippery slope of cognitive decline. Two months after the 61-year-old Perry was unable to remember the agency, he suspended his presidential campaign. The gaffe haunts our cultural memory as a possible – even probable – reason for the suspension

and points to the salience of cognitive status in the United States today. No one wants such doubt, ridicule, or stigma to be applied to them.

Six years before this incident, the Centers for Disease Control and Prevention (CDC) received a $1.6 million appropriation from Congress to form a partnership with the Alzheimer's Association for a new program to be conducted through its Healthy Aging Program. This program, The Healthy Brain Initiative (HBI), would focus on lifestyle behaviors that could maintain or improve cognitive functioning. In 2007 the HBI published its central document, *The Healthy Brain Initiative: A National Public Health Road Map to Maintaining Cognitive Health* (hereafter *The Road Map*). The document alludes to and positions the Initiative among several intellectual traditions and is a good place to start in our analysis of arguments in offering public health recommendations for cognitive health.

The *Road Map* opens the conversation by arguing broadly that "public health should step forward to address cognitive health." The Executive Summary from the *Road Map* below positions the initiative within four emerging areas of professional practice: health promotion within public health, successful or healthy aging within gerontology, evidence-based practice within public health, and cognitive health within psychology and neuroscience. That none of these fields have well established traditions will illustrate how difficult the emergence of a consideration of cognitive health in aging has been.

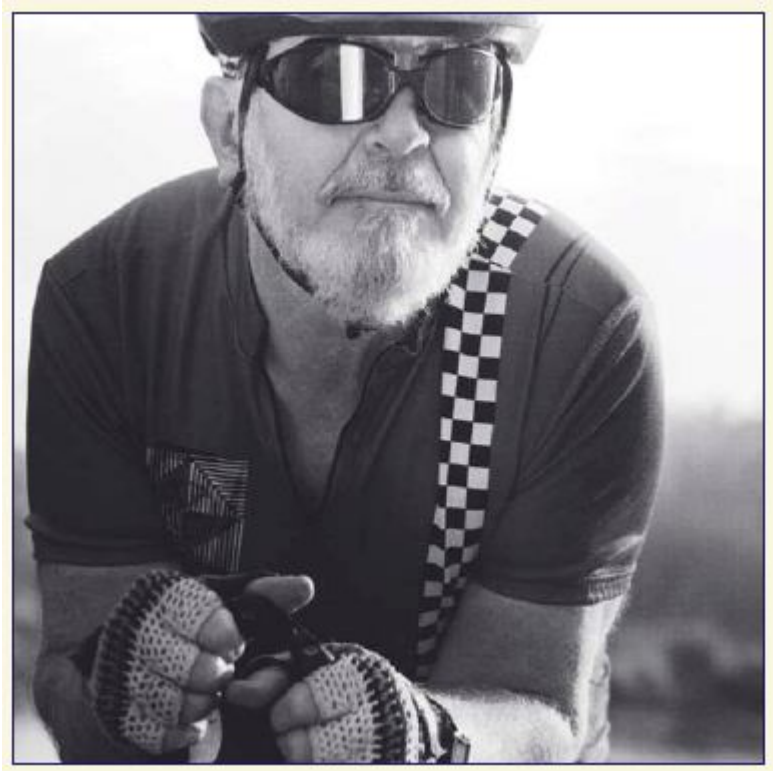
> **Executive Summary**
>
> In Fall 2005, the Centers for Disease Control and Prevention and the Alzheimer's Association formed a new partnership to examine how best to bring a public health

perspective to the promotion of cognitive health. To assist with this Healthy Brain Initiative, the Partners worked closely with the National Institute on Aging and the Administration on Aging to convene a multidisciplinary Steering Committee and an even wider array of invited experts from concerned public and private sector organizations. Together we examined the current state of knowledge regarding the promotion and protection of cognitive health, identified important knowledge gaps, and defined the unique role and contributions of public health. We focused on vascular risk factors and physical activity because of their association with cognitive outcomes, adopted a strategic framework, and embarked on an intensive process to generate the actions offered in this *National Public Health Road Map to Maintaining Cognitive Health*.

The Road Map recognizes current social trends and other factors that affect cognitive health from a public health standpoint: an aging population, growing fear and concern expressed by many people as they age about their potential loss of cognitive function, increasing societal burden from cognitive decline, greater caregiver burden, and a continued lack of awareness about cognitive health among consumers and providers alike.

With this backdrop, we offer a lofty but achievable longterm goal:

To maintain or improve the cognitive performance of all adults.



To accomplish this goal, we propose a set of 44 actions that are firmly grounded in science, emphasize primary prevention, assume a community and population approach, and are committed to eliminating disparities in personal health and health care for racial or ethnic groups. It is critical to note that each priority action is based on a detailed, scientific rationale, with implementation to be based on demonstrated effectiveness of specific interventions. These actions should therefore be considered in the context of the rationales presented in Section V of the Road Map. Within the full set of actions are 10 priorities worthy of immediate attention:

- Determine how diverse audiences think about cognitive health and its associations with lifestyle factors.
- Disseminate the latest science to increase public understanding of cognitive health and to dispel common misconceptions.
- Help people understand the connection between risk and protective factors and cognitive health.
- Conduct systematic literature reviews on proposed risk factors (vascular risk and physical inactivity) and related interventions for relationships with cognitive health, harms, gaps and effectiveness.
- Conduct controlled clinical trials to determine the effect of reducing vascular risk factors on lowering the risk of cognitive decline and improving cognitive function.
- Conduct controlled clinical trials to determine the effect of physical activity on reducing the risk of cognitive decline and improving cognitive function.
- Conduct research on other areas potentially affecting cognitive health such as nutrition, mental activity, and social engagement.
- Develop a population-based surveillance system with longitudinal follow-up that is dedicated to measuring the public health burden of cognitive impairment in the United States.
- Initiate policy changes at the federal, state, and local levels to promote cognitive health by engaging public officials.
- Include cognitive health in Healthy People 2020, a set of health objectives for the nation that will serve as the foundation for state and community public health plans.

It is our hope that these 10 priority actions will serve to focus the nation's resources on addressing risk and protective factors for promoting cognitive health over the next 3-5 years. As a living and flexible document, the Road Map represents both a call to action and a guide for implementing an effective coordinated

> approach to moving cognitive health into public health practice. The key to success lies in continuing and expanding research; developing and channeling resources; working to develop or strengthen partnerships with likeminded organizations; designing collaborative operational plans of action; and establishing systems to track progress, facilitate communication, and exchange information.
>
> Continued vigilance on this issue, and timely translation of research findings into community action, will assure that we reap the potential rewards that public health can offer in improving quality of life among adults and reducing societal costs for health care and other services.[1]

Several pages after the Executive Summary, the Road Map calls for establishing a place within public health for cognitive health: "Given the tremendous burdens described, their impact, and the developing science, public health should step forward to address cognitive health."[2]

Health Promotion

The *Road Map* clearly emphasizes that the Healthy Brain Initiative is a health promotion effort. It begins, "In fall 2005, the Centers for Disease Control and Prevention and the Alzheimer's Association formed a new partnership to examine how best to bring a public health perspective to the promotion of cognitive health." It continues, "[W]e examined the current state of knowledge regarding the promotion and protection of cognitive health..." and offered "a lofty but achievable long-term goal: *To maintain or improve the cognitive performance of all adults*."[3] Promoting, protecting, maintaining, and improving

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[1] Centers for Disease Control and Prevention and the Alzheimer's Association, *The Healthy Brain Initiative: A National Public Health Road Map to Maintaining Cognitive Health*. (Chicago, IL: Alzheimer's Association, 2007), 1-2.

[2] Ibid., 15.

[3] Ibid., 1-2.

are all its stated goals. The *Road Map* therefore evokes the discourse of health promotion and raises a question about the meaning of health promotion, as distinct from longstanding public health efforts such as health prevention. Proposing "a set of 44 actions that ... emphasize primary prevention" makes clear that the Initiative's emphasis is not on treating disease or permanent disability (tertiary prevention) or preventing the development of risk factors from turning into disease (secondary prevention), but on extending the period of health and preventing risk factors from occurring in the first place. Proposing to include cognitive health in Healthy People 2020 further solidifies the effort's health promotion affiliation.

Writing in the same year that the *Road Map* was published, David V. McQueen and Ilona Kickbusch asserted that "health promotion is the avant-garde of public health. It is the basis of the shift away from the focus of public health on disease to a focus on health."[4] In an applied sense, health promotion within public health usually means encouraging healthy behaviors or environments through public health messages, community interventions, or policies. The concept of the modern health promotion movement originated in the 1970s with a group of foundational policy documents generally agreed to consist of the *Lalonde Report in Canada*, *Healthy People* in the US, and documents from the World Health Organization such as the *Ottawa Charter*.[5]

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[4] Louise Potvin and Ilona Kickbusch, "Introduction: The Origins of the Third Public Health Revolution Leading to a New Public Health," in David V. McQueen, Ilona Kickbusch, Louise Potvin, Jurgen M. Pelikan, Laura Balbo, and Thomas Abel, *Health Modernity: The Role of Theory in Health Promotion* (New York: Springer, 2007), 4.

[5] For example, Louise Potvin and David V. McQueen, "Critical Issues in Theory for Health Promotion," in *Health Modernity: The Role of Theory in Health Promotion* (New York: Springer, 2007), 28.

These manifestos were followed by scholarly analysis and criticism beginning in the mid-eighties.

The *Lalonde Report*, penned by Canadian Minister of National Health and Welfare Marc Lalonde, asserted that "Complete well-being for all may be beyond our grasp, given the human condition, but much more can be done to increase freedom from disease and disability, as well as to promote a state of well-being sufficient to perform at adequate levels of physical, mental and social activity, taking age into account."[6] The report introduced the Health Field Concept, a four-component perspective that included 1) human biology (basic sciences), 2) the environment, and 3) lifestyle, which helped move the field away from a traditional focus on 4) health care organization. It emphasized the cost effectiveness of using primary prevention across the four components as compared with consequent medical treatment.[7] The report mainly sought to avoid negative health outcomes, especially death (major causes of death, infant mortality, accidents, drug addiction, suicide, and so forth).

The report *Healthy People* in the US also stressed the need for primary prevention, especially in a world where the "revolution" against infectious diseases had largely been won and there was a need for a "second public health revolution" against chronic diseases including heart disease, cancer, and stroke.[8] The report evoked Greek mythology to distinguish health promotion from health

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[6] Marc Lalonde, *A New Perspective on the Health of Canadians: A Working Document*, (Ottawa: Government of Canada Ministry of National Health and Welfare, 1981), 8.

[7] Ibid, 32.

[8] U.S. Department of Health, Education, and Welfare, *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention*, DHEW (PHS) Publication No. 79-55071 (Washington, DC: United States Public Health Service, 1979), vii.

treatment, noting that the God of medicine Aesculapius had two daughters, Panacea who medicated the sick and Hygeia who governed "living wisely and preserving health."[9] The report outlines in multiple chapters five different age categories and three different actions for health, namely Preventive Health Services, Health Protection, and Health Promotion. The chapter on Health Promotion is concerned with behavioral factors that are presented as being within personal control, such as the reduction of bad habits (smoking, alcohol, drugs, and stress) and the increase of good ones (nutrition and exercise and fitness).[10] The next chapter, "Risks to Good Health," frames the report, establishing health as an assumed baseline that can be built up or eroded in various ways. *Healthy People* became the basis for *Healthy People 1990*, *Healthy People 2000*, *Healthy People 2010*, and *Healthy People 2020*, a comprehensive set of national health promotion objectives offered at the start of a decade intended to drive public health efforts for the next ten years.

The World Health Organization, in its constitution of 1948, issued one of the few widely recognized formal definitions of health at the policy level: "a complete state of physical, mental and social well-being, and not merely the absence of disease or infirmity."[11] However, it remained for later documents to interpret the meaning of this definition for the purposes of health promotion. In the same year that *Healthy People* was published, the World Health Organization

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[9] Ibid., 6.

[10] Ibid., 119-138.

[11] World Health Organization, *Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference*, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948, http://www.who.int/about/definition/en/print.html (accessed November 8, 2012).

issued a "Global Strategy for Health for All by the Year 2000" based on its resolution that "by the year 2000, all people in all countries should have a level of health that will permit them to lead a socially and economically productive life. This implies that the level of health of all people should be at least such that they are capable of working productively and of participating actively in the social life of the community in which they live."[12] The document stressed also the role socioeconomic problems played in health, emphasized the need to reduce health status inequalities within and across countries, and the venues for health improvement: "health begins at home, in schools and in factories. It is there, where people live and work, that health is made or broken."[13] The evocation of different environments in the quest for equality implied that health is a society-wide effort involving citizens, employers, educators, policymakers, and others. Indicators of health in the report included the infant mortality rate, life expectancy at birth, adult literacy rate, and per capita gross domestic product.

We see a variety of concepts across the health promotion literature, from the *Lalonde Report*'s stress on freedom from disease and disability and death, in part through lifestyle behaviors, to *Healthy People*'s interest in "improvement in health, mobility and independence"[14] for older people through, in part, "living wisely," and the World Health Organization's emphasis on social productivity and participation. Some scholars assert that the health promotion discourse was crystallized with the World Health Organization's *Ottawa Charter* of 1986. They assert this because the document reflected a new awareness of extended longevity

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[12] World Health Organization, *Global Strategy for Health for All by the Year 2000* (Geneva: World Health Organization, 1981 [1979]), 31.
[13] Ibid.
[14] *Healthy People*, 1979, 9.

in the late 20th century that provoked interest "not only about how to avoid being sick, a negative, but also about how to expand the potential for living, a positive view of health."[15]

The *Ottawa Charter* defined health promotion as "the process of enabling people to increase control over, and to improve, their health. To reach a state of complete physical, mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities."[16] The prerequisites of health include peace, shelter, education, food, income, a stable eco-system, sustainable resources, social justice, and equality. According to this new framing, health promotion moves far beyond the clinic and into the environments in which people live: "Health is created and lived by people within the settings of their everyday life; where they learn, work, play and love."[17] These settings include supporting environments built around reciprocal maintenance and supported by evidence that people are the main health resource – people through their actions, their family, and their friends. Far from being something intact that can be impaired so that it needs to be repaired, health is "a major social investment and challenge."[18]

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[15] Lester Breslow, "From Disease Prevention to Health Promotion," *JAMA* 281, no. 111 (1999), 1031.

[16] "Appendix: Ottawa Charter for Health Promotion," in McQueen et al., *Health Modernity: The Role of Theory in Health Promotion* (New York: Springer, 2007), 162-166.

[17] Ibid.

[18] Ibid.

The *Ottawa Charter* came on the heels of a landmark paper summarizing empirical data on the positive effects of the social environment, including social support.[19] The research literature explained the beneficial health effects of social support in two theoretical ways, either by protecting against the mainly negative behavioral effects of stress such as substance abuse (the stress *buffering model*) or else as promoting stability, self worth, social integration which might have direct effects on the neuroendocrine or immune system functioning or other positive health outcomes (the *main- or direct- effect model*). The main effect model had been present since the 1970s but became more compelling and prominent through the work of the Alameda County Study that Lester Breslow led, showing both positive and negative effects of lifestyle on health.[20] Those involved with the Alameda County Study, most notably Lisa Berkman, would go on to research the positive effects of social networks on incident cognitive decline for seniors with the Established Populations for Epidemiologic Studies of the Elderly (EPESE).[21]

To Lester Breslow the definition of health "as a resource for everyday life" was nothing less than a "third public health revolution ... devoted to advancing health in the sense of maximizing it as a resource for living."[22] Conceptualizing health as a continuum with the aim of moving it towards the positive end, Breslow saw the building of reserves as the engine: "health potential consists of

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[19] Sheldon Cohen and Thomas Ashby Wills, "Stress, Social Support, and the Buffering Hypothesis," *Psychological Bulletin* 98, no. 2 (1985): 310-357.

[20] Lisa F. Berkman and Lester Breslow, *Health and Ways of Living: The Alameda County Study* (New York: Oxford University Press, 1983).

[21] Shari S. Bassuk, Thomas A. Glass, & Lisa F. Berkman, "Social Disengagement and the Incident Cognitive Decline in Community-Dwelling Elderly Persons,"*Annals of Internal Medicine* 131, no. 3 (1999):165-173.

[22] Breslow, "From disease prevention to health promotion," 1031.

reserves—an individual's capacity to cope with environmental influences that jeopardize health balance" and "promoting health must focus on enhancing people's capacities for living."[23] Examples of reserves were not just abilities that could be strengthened (physical and mental) but also forms of social support.

Other scholars working in public health since the time of the Ottawa Charter have objected to this new conceptualization. Those taking a "free-market perspective" have described health promotion as a form of social engineering through lifestyle interventions, creating lifestyle police that force people to stop taking risks to the detriment to the identities they want to live.[24] However, the main complaint against health promotion is that it has very few codified professional practices, few professional organizations, and little consensus on what would constitute a health promotion practice, thereby making it vulnerable to the decision making of more established disciplines.[25] Sociologist Aaron Antonovsky warned that this area of practice was in danger of stagnation because it did not have an autonomous existence apart from health prevention. Like the practice of health prevention, the practice of health promotion has traditionally assumed that people are "naturally" healthy and need to remain that way. Only the assumption that the "human system" is "inherently flawed" and could always be improved creates a place for health promoters.[26] The important question then

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[23] Ibid.

[24] Charlie Davison and George Davey Smith, "The Baby and the Bath Water: Examining Socio-Cultural and Free-Market Critiques of Health Promotion," in *The Sociology of Health Promotion: Critical Analyses of Consumption, Lifestyle, and Risk*, ed. Robin Bunton, Sarah Nettleton, and Roger Burrows (London: Routledge, 1995), 91-102.

[25] McQueen et al., *Health Modernity*, 15-16.

[26] Aaron Antonovsky, "The Salutogenic Model as a Theory to Guide Health Promotion." *Health Promotion International* 11, no. 1 (1996), 13-14.

becomes "How can [a] person be helped to move towards greater health?"[27] and, most profoundly, *What is health?* Antonovsky's answer is a "sense of coherence" that he attempts to operationalize as an outcome to help drive the search for the determinants of that outcome.[28]

Health promotion has been characterized as "a Eurocentric phenomenon."[29] However, in 1999 an eleven-scholar American committee was charged by the Institute of Medicine to identify promising intervention strategies, promising research directions, and promising funding strategies to encourage health promotion in the US. Through consensus, they placed their recommendations within an ecological model that assumes that biology, behavior, and the environment interact dynamically to influence health over the life course. One of their recommendations for research was to "Identify sources of health strengths and resilience, as well as health risks, among individuals, families, and communities of low socioeconomic status and racial and ethnic minority groups."[30] Most of the recommendations of the committee, however, remained within the framework of a traditional disease-focused health prevention realm.

A landmark American theory related to the concept of health promotion has been James Fries' *compression of morbidity hypothesis*. This theory suggests that against an assumed finite life span and trends towards fewer disabilities and better health, illnesses can be compressed into a shorter and

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[27] Ibid., 14.
[28] Ibid.
[29] Theodore H. MacDonald, "Health Promotion: A Eurocentric Phenomenon," in *Rethinking Health Promotion: A Global Approach* (London: Routledge, 1998): 33-44.
[30] "Introduction," in *Promoting Health: Intervention Strategies from Social and Behavioral Research*, ed. Brian D. Smedley and S. Leonard Syme (Washington, DC: National Academy Press, 2000), 21.

shorter period of time before death. Where health can be extended long enough, death will arrive before illness and marked decline, drastically reducing both personal suffering and societal expense. Fries asserts his idea as both a theory and a preventive health manifesto to be pursued by policymakers.[31] The *Road Map*'s reference to "improving quality of life among adults and reducing societal costs for health care and other services" evokes Fries' vision.

The "new public health" stemming from the Ottawa Charter sets up health as a resource for daily living. There are health reserves that can be built up, depleted, or restored through various activities of living. Health promotion works by encouraging investment in reserves at the individual level, through the creation of environments that support the building of reserves and minimize their depletion. Coexisting with this articulated vision, however, are other versions of health promotion that remain unarticulated and at times virtually indistinguishable from health prevention. David V. McQueen has stated, "For health promotion there has rarely been a critical look at the motivations of the practitioners, nor little appreciation for the political and social context in which the practice is pursued."[32] Despite positive efforts to define health resources that can be promoted, public health did not seriously embrace cognitive health promotion until the 21st century. One could expect that when it did embrace it, the concept of cognitive health would include the idea of building up cognitive reserves.

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[31] James Fries, "Aging, Natural Death, and the Compression of Morbidity," *New England Journal of Medicine* 303, no. 3 (1980):130–35.

[32] McQueen et al., *Health Modernity*, 2007, 26.

Successful Aging

Health promotion describes a broad public health goal. However, it does not specify health outcomes for an aging population. An important consideration in this area is, *What does the desired health in aging look like?*

The *Road Map*'s Executive Summary features a photograph of a middle-aged bicyclist that seems to provide a clear answer to this question. The man appears to be leaning forward on the handlbars of a bicycle. He is smartly dressed in cyclist-specific attire, including a shirt with a vertical checkerboard motif (evoking a car racing flag), a cycling helmet, mesh gloves with cut-out fingers, and sunglasses glinting with sunlight. He is tanned, muscular, with well-groomed facial hair, high shirt cut low and chest visible. The text beneath the photo, "To accomplish this goal, we propose a set of 44 actions..." visually captioning the photo by leading the eye to encompass the word "goal" and the photo simultaneously, suggesting that the photo is a depiction of the goal ("*To maintain or improve the cognitive performance of all adults*") that visually precedes the photo. Depicting cognitive health in this way seems to be a visual equivalent of attempts to define and depict positive or healthy aging in general within the field of successful aging. According to this visual, a person with cognitive health is active, outdoorsy, and socially attuned.

Considerable gerontological literature is devoted to the concept of "successful aging." While more recent than the health promotion literature, it is nevertheless vast, encompassing similar constructs as "optimal aging," "healthy

aging," "active aging," and "productive aging." The dominant health models within this literature both use the term "successful aging."[33]

The use of the term "success" may have something to do with the way that population aging is often presented triumphantly as an accomplishment of public health efforts across the 19th and 20th centuries, which vastly improved hygienic conditions and reduced child mortality and increased average life expectancy in the United States from 49.2 years in 1900 to 77.5 years today.[34] Such "successes" may, however, only be pyrrhic if they save lives without improving the quality of those lives. The success that most people seek and desire is an extended period of vitality. Similarly, medicine now has many pharmaceutical and technological tools to extend life, but life extension alone is questionable on both personal and social levels only if it promotes an extended period of dependency on an expensive healthcare system. Gerontologist Ken Dychtwald wrote in 1999, "We have emphasized the prolongation of life and the denial of death, but we have done little to promote healthy aging."[35] He invoked the Greek myth of Tithonus,

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[33] Ed. Paul B. Baltes and Margret M. Baltes, *Successful Aging: Perspectives from the Behavioral Sciences* (Cambridge: Press Syndicate of the University of Cambridge, 1990) and John W. Rowe and Robert L. Kahn, *Successful Aging* (New York: Dell Publishing, 1998). Robert J. Havighurst is sometimes credited with coining the term "successful aging," although there are at least casual references to it even earlier; see Havighurst, "Successful Aging," *The Gerontologist* 1, no. 1(1961): 8, which defines it in purely social terms, describing two sociological theories of aging, disengagement theory and activity theory, as "two theories of successful aging." Disengagement theory proposes that disengaging from society with age is the way elders successfully manage aging processes, whereas activity theory suggests that continued engagement is the way that they stay vital. Havighurst did not address health at all. Erdman Palmore continues the discussion in similar terms with evidence from the First Duke Longitudinal Study that support activity theory – see Erdman Palmore, "Predictors of successful aging," *The Gerontologist* 19, no. 5 (1979), 427-31.

[34] Laura B. Shrestha, "Life Expectancy in the United States" Congressional Research Service The Library of Congress, CRS Report for Congress RL32792, updated August 16, 2006, CRS Web http://aging.senate.gov/crs/aging1.pdf (accessed November 8, 2012).

[35] Ken Dychtwald, "Introduction: Healthy Aging or Tithonius' Revenge?" in ed. Ken Dychtwald, *Healthy Aging: Challenges and Solutions* (Gaithersburg: Aspen Publishers, Inc., 1999), 1.

the warrior who was granted immortal life without immortal health and suffered eternally for it. The cultural trope of immortal ill-health has been strong through the ages, warning us against committing a similar error through practices and policies today. One could also invoke the myth of the Sybil of Cumae or Jonathan Swift's depiction of the Struldbruggs in *Gulliver's Travels*. In contrast to successful life extension, "successful aging" connotes living well – in a range from simply managing to triumphing over the biological processes of aging, depending on the source.

In a review of the definitions of successful aging since the 1960s, physicians Elizabeth Phelan and Eric Larson describe a line of history moving the concept through three fields of research, the social sciences in the 1960s and 1970s, psychological and behavioral sciences in the 1980s and 1990s, and finally medicine and healthcare in the late 1980s extending to the 2000s.[36] The dominant successful aging paradigm within psychology and behavioral sciences was formulated by two German psychologists, experimental psychologist and director of the Max Planck Institute on Human Development Paul Baltes and clinical psychologist Margret Baltes at the Berlin Free University.[37] The Baltes and Baltes model proposed strategies for coping with age-related change in a way that enabled high-level functioning.

Psychologists Baltes and Baltes begin their argument with the observation of extensive heterogeneity as well as enormous plasticity within individuals as

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[36] Elizabeth A. Phelan and Eric B. Larson, "Successful Aging – Where Next?" *JAGS* 50, no. 7 (2002):1306.

[37] Paul B. Baltes and Margret M. Baltes, "Psychological Perspectives on Successful Aging: The Model of Selective Optimization with Compensation," in ed. Baltes and Baltes, *Successful Aging*, 1990, 1-34.

measured by latent reserve (physical, mental, cognitive, and social) to develop abilities. The authors invoked Cicero as a precursor to their argument by recognizing the combined limitation and potential of age-related change. Where some may see only loss with age, Cicero saw the potential to gain focus through that loss. With physical decay, for example, may come mental virtues. The authors then presented their concept of successful aging, placing it within an optimistic turn within gerontology. Their concept is squarely built around behavioral plasticity or adaptability and accommodates numerous individually defined life goals, in contrast to other approaches that define an ideal state. The authors next proposed a seven-proposition framework for resilience in old age, despite a developmental shift of increasing developmental losses and dwindling developmental gains. They presented an overview of multiple strategies of supporting successful aging, from individual behavior (i.e., building up reserves) to greater societal action (e.g., building supportive environments). Finally, they proposed a three-part model of adaptation that fits empirical observation on what has helped older people thrive: 1) Selecting focal points for effort (i.e., one's priorities), 2) Optimizing those efforts (e.g., through increased attention on priority activities), and 3) Compensating for deficiencies with different skills, technology, or other resources – SOC for short. As psychologists, Baltes and Baltes were particularly interested in cognition. They noted that while fluid intelligence (which they call mechanics) declines with age, crystallized intelligence (which they call pragmatics) does not and can be recruited to compensate for declining fluid intelligence. In addition, culture becomes more important with age and can help by providing needed environmental support or

technologies. In sum, Baltes and Baltes model defines "success" qualitatively and individualistically as the ability to adapt to change.

John Rowe and Robert Kahn proposed an overlapping but very different approach to successful aging in two seminal papers published in 1987 and 1997, respectively. In 1987 they published a seminal paper in *Science* that put forth a new concept of successful aging. A geriatrician, Rowe was president of Mt. Sinai Hospital and School of Medicine who went on to become the CEO of the health insurance corporation Aetna Inc. Robert Kahn was a professor of social psychology and public health at the University of Michigan. Their paper reads as a kind of manifesto extrapolated from a review of health-related gerontological literature.

Like Baltes and Baltes, Rowe and Kahn begin by pointing out the vast heterogeneity that exists in older adults. They critique traditional physiological classifications of older people as either diseased or "normal."[38] According to the authors, this dichotomy is too crude to account for the vast heterogeneity in the so-called "normal" group. Representing the "normal" group as a statistical average conflates and nullifies the high performance of some older people with the low performance of others. In order to recognize the high performers, the authors split the "normal" (nondiseased) category into two categories, a "usual" aging group who possess risk factors for age-related diseases and a "successful" aging group who show none of these risk factors. The authors then deconstruct the link between biological age and common pathological conditions in later life

[38] John W.Rowe and Robert L. Kahn, "Human Aging: Usual and Successful," *Science* 237, no. 4811 (1987), 143.

by pointing to a stronger connection between modifiable lifestyle factors. Such "age-extrinsic" lifestyle factors that are linked to health conditions include diet in insulin resistance, exercise in osteoporosis, and education level in cognitive decline. The authors conclude with evidence of psychosocial factors that can promote wellbeing in older people, such as autonomy and control, social support, especially during major life transitions through direct or indirect pathways. They lay out a broad interdisciplinary research agenda to investigate an apparently increasing functional heterogeneity of age, a departure from research that attempts to establish norms.[39] Their recommendations are 1) to use the usual vs. successful aging distinction, 2) to focus on transitions in later life, and 3) to study modifiable lifestyle behaviors in aging. In short, "a revolutionary increase in life span has already occurred. A corresponding increase in health span, the maintenance of full function as nearly as possible to the end of life, should be the next gerontological goal."[40] This article took the "first step – breaking out of the disease framework and redefining successful aging."[41]

On the heels of their manifesto, Rowe and Kahn received $10 million in funding from the MacArthur Foundation to establish the Research Network of Successful Aging Community Study to describe high-performing elders. The work used data from the Established Populations for the Epidemiological Study of the Elderly (EPESE) programs in three communities (East Boston, Ma, New Haven, CT, and Durham County, NC) to describe those people aged 70-79 who tested in the top third of the group in terms of cognitive and functional measures.

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[39] Ibid., 237.
[40] Ibid., 149.
[41] See comments in Rowe and Kahn, *Successful Aging*, xiii.

The research focused on what happened to cognitive function (for example, memory), physical performance (for example, walking ability), productive activity (for example, volunteering) after three and seven years and looked at performance levels in relation to an array of behavioral (e.g., alcohol, smoking, physical activity), psychosocial (relationships, efficacy, and so forth), and physiological factors (e.g., hormone levels).

Using this information and other data, Rowe and Kahn published a second landmark paper in 1997 that proposed three specific criteria for inclusion in this category of successful aging. 1) low risk for disease and disability, 2) high physical and cognitive functioning, and 3) active engagement with life.[42] They conceived the three elements as somewhat hierarchical, so that ultimately it is important to have the third (engagement with life), but it is very difficult to have the third if you do not have either the first or the second. They interpreted the research as pointing to extrinsic environmental factors such as lifestyle as playing a large role in determining risk factors. Furthermore, they see the potential for lifestyle modification before the risk factors manifest to keep people in the "successful aging" category. The authors ultimately presented their work in the trade book *Successful Aging* (1998), which help to popularize its appeal.[43]

Within the American gerontological health literature, the Rowe and Kahn model of successful aging appears to predominate. There are a number of reasons why this may be the case. First, the very fact that the authors are Americans may have encouraged the dissemination and popularity of their model.

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[42] John W. Rowe and Robert L. Kahn, "Successful Aging," *The Gerontologist* 37, no. 4 (1997), 433.

[43] Rowe and Kahn, *Successful Aging*, 1998.

Second, the fact that one author is a medical doctor and the other is a public health scholar directly touches the two poles of the American healthcare system and suggests the applicability of the framework. Third, their definition as laid out can be measured in fairly clear-cut ways whereas the Selective Optimization with Compensation (SOC) model has not been well operationalized. The model is cited within public policy arenas in the United States. For example, a chapter authored by Hugh C. Hendrie et al. within the book *Successful Cognitive and Emotional Aging* describes the "need to try and preserve patients' functioning," as a "change of focus from disease to health"[44] at advocacy organizations such as the Alzheimer's Association and AARP as well as at major research institutes. They cite the Rowe and Kahn's "new gerontology" as the source of this change and the NIH Cognitive and Emotional Health Project (CEHP) and the Healthy Brain Initiative as examples of its influence. For its part, the HBI *Road Map* acknowledges the influence of the CEHP, and the CEHP cites Rowe and Kahn's landmark 1987 paper as its first reference.[45]

Despite its influence and effect on policy change, the Rowe & Kahn model of successful aging has also been severely critiqued. Matilda White Riley found fault with authors for putting too much emphasis on individuals and for omitting structural aspects that might contribute to "unsuccessful" aging.[46] Elizabeth Phelan and Eric Larson point out the paucity of research on older individuals'

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[44] Hugh C. Hendrie, Christianna Purnell, Alissa H. Wicklund, and Sandra Weintraub, "Defining and Assessing Cognitive and Emotional Health in Later Life," in ed. Colin A. Depp and Dilip V. Jeste, *Successful Cognitive and Emotional Aging* (Washington, DC: American Psychiatric Publishing, Inc., 2010), 17-36.

[45] Hugh C. Hendrie, Marilyn S. Albert, Meryl A. Butters, Sujuan Gao, David S. Knopman, Lenore J. Launer, Kristine Yaffe, Bruce N. Cuthbert, Emmeline Edwards, and Molly V. Wagster, "The NIH Cognitive and Emotional Health Project: Report of the Critical Evaluation Study Committee," *Alzheimer's & Dementia* 2, no. 1 (January 2006): 12-32.

[46] Matilda White Riley, "Letters to the Editor," *The Gerontologist* 38, no. 2 (1998): 151.

perspectives on the topic.[47] Martha Holdstein and Meredith Minkler expose the concept as resting on unarticulated values around virtue in health and point to dangers of such expert-driven definitions, which set up social judgments by, for example, excluding disabled people from the category of "successful aging." In this respect it inadvertently marginalizes women who make up most of the older people with chronic diseases, and gives policymakers a rationale for not intervening at the social level.[48] Following the work of Rowe and Kahn, it appears that "the dominant culture accepts as the desired norm the tanned, vigorous couple who are bicycle riding on gently rolling hills and dining in the warm glow of candles" and is more apt to mentally marginalize the "already marginalized" such as people who are poor, less educated, and more disabled.[49]

The most widely cited problem of the Rowe and Kahn model is how few people are eligible for inclusion in the "successful aging" status. Although the MacArthur Foundation Research Network on Successful Aging Community Study found that 32.6% of the sample studied met the "high functioning" criteria,[50] other researchers have pointed out that performing in the top third of a sample of older adults does not necessarily mean these adults are doing well.[51] In fact, while using data from the MacArthur Foundation Research Network on Successful Aging Community Study to come up with their 1997 model of

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[47] Phelan and Larson, "Successful Aging – Where Next?"

[48] Martha B. Holstein and Meredith Minkler, "Self, Society, and the 'New Gerontology,'" *The Gerontologist* 43, no. 6 (2003): 787-796.

[49] Ibid., 791.

[50] Lisa F. Berkman, Teresa E. Seeman, Marilyn Albert, Dan Blazer, Robert Kahn, Richard Mohs, et al., "High, Usual and Impaired Functioning in Community-Dwelling Older Men and Women: Findings from the MacArthur Foundation Research Network on Successful Aging," *Journal of Clinical Epidemiology* 46, no. 10 (1993), 1129-1140.

[51] Margaret von Faber, Annetje Bootsma-van der Wiel, Eric van Exel, Jacobign Gussekloo, Anne M. Lagaay, Else van Dongen, et al., "Successful Aging in the Oldest Old: Who Can Be Characterized as Successfully Aged?" *Archives of Internal Medicine* 161 (2001): 2694-2700.

successful aging, Rowe & Kahn came up with a much more exclusive definition than the "high functioning" starting point based on how people changed over time. Using the Rowe and Kahn definition of successful aging, a Dutch research group found that only 10% of adults age 85 and older in a large study met the criteria. However, most people considered themselves to be successfully aging based on an adaptive definition.[52] HAP Director Lynda Anderson and colleagues helped conduct a mail survey study of cohorts age 65 and older, finding that adults embraced different attributes than those deemed by researchers as marks of "success" such as perceptions of autonomy, control, and coping, which were missing from the Rowe & Kahn model.[53] A regional study found that only 18.8% of participants aged 65-99 met Rowe and Kahn's criteria for successful aging (compared with 50.3% who self classified themselves as aging successfully),[54] whereas a national sample yielded prevalence rates of no greater than 11.9%.[55] These findings all suggest that the Rowe and Kahn model is probably too restrictive and very likely will need to undergo revision.

While much attention has focused on measurement issues and the exclusiveness of the category, less attention has been given to the impact of creating a "successful" category that dissociates biological aging processes from health. The creation of a category of people who are essentially untouched by

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[52] Ibid.

[53] Elizabeth A. Phelan, Lynda A. Anderson, Andrea Z. LaCroix, and Eric B. Larson, "Older Adults' Views of 'Successful Aging' – How Do They Compare with Researchers' Definitions?" *JAGS* 52, no. 2 (2004):211-216.

[54] William J. Strawbridge, Margaret I. Wallhagen, and Richard D. Cohen, "Successful Aging and Well-being: Self-rated Compared with Rowe and Kahn," *The Gerontologist* 42, no. 6 (2002): 727-33.

[55] Sara J. McLaughlin, Cathlee M. Connell, Steven G. Heeringa, Lydia W. Li, and J. Scott Roberts, "Successful Aging in the United States: Prevalence Estimates from a National Sample of Older Adults," *Journal of Gerontology: Social Sciences* 65B, no. 2 (2010): 216-226.

aging until the very ends of their lives means that “aging” could potentially be eradicated. This perspective is profoundly different from the Baltes and Baltes model, which recognizes a tilt in the balance of developmental processes from growth to loss with age and addresses active forms of compensation to optimize health and functioning. At the level of national policy, the emergence of a new category of old age untouched by the process of aging casts confusion over the old terms of “aging,” “normal,” and “decline” and urgently calls for a clearer definition of terms. The need has not been adequately recognized or publicized, and the conceptual confusion poses difficulties for ongoing successful aging research programs.

Evidence-based Practice

If health promotion and successful aging describe broad and specific public health goals, respectively, the *Road Map*’s references to proposed actions “that are firmly grounded in science” including those that would “disseminate the latest science,” “conduct systematic literature reviews,” and “conduct controlled clinical trials,” all refer to the quality and level of approach. Collectively these references ally the Healthy Brain Initiative with the emerging field of evidence-based practice.

“Evidenced-based” means emerging from scientific research, as opposed to “practice,” which indicates the level at which programs and interventions are administered to the public. The HBI *Road Map* is described as “a guide to assist in implementing a coordinated approach to moving cognitive health into public

health practice."[56] It articulates three core public health functions that need to be addressed: 1) assessment of communities' health status and needs, 2) policy development, or "science-based decision making," and 3) assurance, or the implementation of programs and effective interventions.[57] Focusing on these three functions places the Healthy Brain Initiative between researchers and decision makers who are producing and evaluating scientific knowledge, on the one hand, and the needs of the communities that are being served, on the other.

The Healthy Brain Initiative conceptualized its pivotal role with the informally termed Push-Pull Model of "moving science into public health practice."[58] This model came from an NIH Office of Behavioral and Social Sciences Research working group, which suggested that three activities work together to increase the use of evidence-based behavioral interventions. They are the "Technology Push," or evaluating and identifying evidence-based interventions for population-wide use; "Market Pull," or building demand for evidence-based interventions; and "Research and Clinical Capacity," or building the capacity to develop, prove, and deliver evidence-based interventions.[59] Using this strategic framework, for the HBI to be useful or successful meant that it needed to evaluate the science base to identify findings that can be brought to meet public demand or to conduct new research to meet the need. To do this it had to build and strengthen capacity by garnering resources, competencies, partnerships, and the like.

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[56] CDC & AA, *Road Map*, 2.
[57] Ibid., 20.
[58] Ibid., 24.
[59] Office of Behavioral and Social Sciences Research, "Putting Evidence into Practice: The OBSSR Report of the Working Group on the Integration of Effective Behavioral Treatments into Clinical Care," obssr.od.nih.gov/pdf/everpt3.pdf (accessed September 30, 2010).

One of the core components of evidence-based public health is systematic reviews of evidence from interventions that are designed to promote health or prevent disease. Anderson et al. (2005) attribute the advent of systematic reviews and evidence-based practice in public health to the establishment of the Task Force on Community Preventive Services in 1996,[60] which culled through research in 12 priority areas to produce its first *Guide to Community Preventive Services* in 2005. Using stringent standards, the Guide found that about 50% of the interventions reviewed in these areas between 1996 and 2004 had "insufficient evidence to determine effectiveness."[61] In 1996, the same year that the Task Force on Community Preventive Services started, a clinical trial review group, the Cochrane Collaboration, started the Cochrane Field of Health Promotion database, which expanded in 1999 to include public health.[62]

Evidence-based practice for public health grew out of evidence-based medicine, a concept that was coined by Guyatt at McMaster University in 1992 and that sought to use the scientific evidence base to inform particular clinical decisions.[63] According to Victora, Habicht, and Bryce (2004), the establishment of the Cochrane Collection and its success encouraged the extension of randomized controlled trials (the "gold standard" of clinical research) to public health and health policy.[64] Rimer, Glanz, and Rasband attribute the establishment and spread of evidence-based public health also to the emergence

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[60] Laurie M. Anderson, Ross C. Brownson, Mindy T. Fullilove, Steven M. Teutsch, Lloyd F. Novick, Jonathan Fielding, Garland H. Land, "Evidence-based Public Health Policy and Practice: Promises and Limitations," *American Journal of Preventive Medicine* 28, no. 5 (2005): 226-230.

[61] Ibid., 227.

[62] Ibid.

[63] Milos Jenicek, "Epidemiology, Evidence-Based Medicine, and Evidence-Based Public Health." *Journal of Epidemiology* 7, no. 4 (1997): 187-197.

[64] Cesar G. Victora, Jean-Pierre Habicht, and Jennifer Bryce, "Evidence-Based Public Health: Moving Beyond Randomized Trials," *American Journal of Public Health* 94, no. 3 (2004): 403.

of managed care and its emphasis on behavioral interventions as a cost-saving measure.[65]

Another way that evidence-based public health is conceived of is in terms of translation. In *translational research* two different kinds of processes may be depicted. At the first level (*translation 1*), basic sciences from animal or chemical laboratories are translated into use in a clinical setting and evaluated as a treatment. At the second level (*translation 2*), research is translated into use in a community setting and evaluated for reaching the people for whom they are intended in the way that they were intended.[66] Woolf laments the fact that the same name "translational research" is used for both processes and that in terms of attention and funding T1 trumps T2.[67] He calls for a new name for T2 to set it apart, receive more funding, and likely save more lives.

Once there is good evidence that programs or interventions do achieve the health results that were intended, public health practitioners at the community level point out that the interventions are in no way guaranteed to help anyone. This is because the causal pathways from an intervention to a health impact are more complex in intervention research than in medicine.[68] In addition to effectiveness (that the input produces the desired output) and efficacy (that it produces the desired output better than competing programs), an evaluation of community-based health programs would have to look at social, economic, and

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[65] Barbara K. Rimer, Karen Glanz, and Gloria Rasband, "Searching for Evidence about Health Education and Health Behavior Interventions," *Health Education & Behavior* 28, no. 2 (2001), 241.

[66] Steven H. Woolf, "The Meaning of Translational Research and Why it Matters," *JAMA* 299, no. 2 (2008): 211-13.

[67] Ibid.

[68] Victora, Habicht, and Bryce, 2004, 401.

political factors. One of the most publicized frameworks for evaluating interventions, the RE-AIM framework, measures the impact of a public health intervention according to its Reach (the number of individuals reached over the total eligible), according to its Efficacy (including both positive and negative measured outcomes), according to its Adoption (the proportion of settings that adopt it), and Maintenance (the transition of an artificial intervention into routine normal practice).[69] The main argument behind frameworks such as RE-AIM is that interventions that are scientifically "proven" in research or clinical settings by randomized controlled trials are attempted to be produced under ideal rather than real-world conditions. It is important to this kind of research that the intervention reaches its target audience. Its proponents weigh the advantages of having a high efficacy intervention with low adoption rates. If an intervention were less efficacious but more acceptable to a community it might be adopted more often, have greater reach and lead to maintenance of the behavior being promoted.[70] In other words, it might improve the health of far more people than the highly efficacious intervention that reached very few. There is as yet no formula for weighing these tradeoffs among the elements of RE-AIM.

Many practitioners have been concerned that the standards of evidence-based public health may be too high and too rigid. Brownson, Gurney, and Land bring up other ways of evaluating interventions for public health besides randomized control trials, including risk assessment, cost effectiveness studies,

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[69] Russel E. Glasgow, Thomas M. Vogt, and Shawn Boles, "Evaluating the Public Health Impact of Health Promotion Interventions: The RE-AIM Framework," *American Journal of Public Health* 89, no. 9 (1999): 1322-1327.

[70] Ibid.

public health surveillance, and expert panels and consensus conferences.[71] The HBI has used the last two methods in its analysis. Ziglio warned early in the evidence-based medicine (EBM) movement that the public health field needed to be active in defining the evidence needed for its aims in order not to be usurped by the new rubric of EBM.[72] For example, health promotion efforts should consider criteria such as equity, acceptability, feasibility, sustainability, and so forth. It should also consider the policy environment, including the economic circumstances of the population. Writes Ziglio, "It is unjust and not scientific to make judgment on the evidence of health promotion by merely considering it as a simple matter of input-output relationships. The policy environment (conducive to health promotion objectives or mitigating against them) must be part of the evidence-based equation."[73] As an example, he describes a context of rising poverty in Europe, which results in change in living conditions. One can imagine the same in the United States and the ensuing difficulties of many people to engage in behavior modification when they are under daily economic duress. In this case, the most efficacious lifestyle modification program such as physical activity program could be wasted in its dissemination and implementation, whereas an environmental policy to develop walkable neighborhoods might fare better although its efficacy may not be proven through a randomized controlled trial. Another criterion deemed important is the magnitude of the problem as

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[71] Ross C. Brownson, James G. Gurney, and Garland H. Land, "Evidence-based Decision Making in Public Health." *Journal of Public Health Management Practice* 5, no. 5 (1999): 86-97.

[72] Erio Ziglio, "How to Move Towards Evidence-based Health Promotion Interventions," *Promotion & Education* 4, no. 2 (1997): 30.

[73] Ibid., 31.

determined by surveillance data or through stakeholder opinion.[74] The magnitude of the problem might make the issue urgent enough to trump waiting for a randomized-controlled trial proven intervention to be translated and tested at the community level. In a sense, such thinking is akin to a cost-benefit analysis. What is the cost of doing nothing? What is the benefit of doing something? What is the cost of doing something if the intervention is not efficacious? Anderson et al. argue that decision makers often need to act in the absence of good evidence. An example they cite for 2005 was needing to do something about child obesity despite the lack of any conclusive evidence of effective school interventions.[75] It is perhaps common sense to make a change to the environment, such as removing candy machines from the premises, to see if school children lose weight, even though the decision might anger vending companies and other local businesses and the evidence for such an intervention is not firmly and scientifically established. Keith Tones notes that RCTs fail health promotion efforts when either they cannot be applied to multi-layered programs delivered over long periods of time, or effectiveness is proven without any clear indication as to the causal agent.[76] He proposes a "judicial review" as the new gold standard, in which those evidence evaluators act somewhat like lawyers in considering different types of sound evidence and triangulate among them.[77]

One of the great stumbling blocks to speedy evidence-based public health interventions is considered to be a deep cultural rift between researchers and

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[74] Anderson et al., 2005, 228.
[75] Ibid.
[76] Keith Tones. "Evaluating Health Promotion: A Tale of Three Errors." *Patient Education and Counseling* 39, no. 2-3 (2000): 227-36.
[77] Ibid., 232-235.

policymakers.[78] Brownson, Royer, Ewing, and McBride argue that researchers have a moral obligation to see their findings applied. However, researchers are not under any professional obligation to do so, and in fact researchers and policymakers rarely have any contact with each other, existing in separate but "parallel universes."[79] These universes operate by different incentives, authorities, scopes of knowledge, sources of knowledge, types of evidence, tolerance of uncertainty, kinds of people to which they are accountable, timeframes, and approaches to communication.[80] The authors urge each group to educate itself about the other in order to form closer bonds to effect the changes that they both desire. Researchers in particular need to get involved in the policymaking process, ensure that their point of view is represented, understand non-scientific factors that drive policy, communicate more effectively, educate congressional staff people, conduct policy research, and build transdisciplinary public health teams.

By the standard of bringing together researchers and policymakers through interdisciplinary public health teams, the Healthy Brain Initiative has been lauded as a success. The Alzheimer's Association, loosely representing the policy world, is pleased to have pulled the CDC into the discussion of cognitive health. The CDC is pleased to have brought public health considerations into the Alzheimer's Association. Researchers and policymakers from fields involved with

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[78] Ross C. Brownson, Charles Royer, Reid Ewing, and Timothy D. McBride, "Researchers and Policymakers: Travelers in Parallel Universes," *American Journal of Preventive Medicine* 30, no. 2 (2006): 164-172; Karen Bogenschneider and Thomas J. Corbett, "Exploring the Disconnect between Research and Policy," in *Evidence-Based Policymaking: Insights from Policy-Minded Researchers and Research-Minded Policymakers* (New York: Routledge, 2010), 1-24.

[79] Brownson et al., 2010.

[80] See Table 2, Brownson et al., 2010, 166.

the project state that the cross-disciplinary discussions challenged both cultures in productive ways.

Cognitive Health in Aging

The HBI's stated goal was "*To maintain or improve the cognitive performance of all adults.*" True to its health promotion purpose, the *Road Map*'s Executive Summary makes no mention of Alzheimer's disease or any other form of dementia but refers to "cognitive health," "cognitive outcomes," "cognitive function," "cognitive performance," and "cognitive decline." For the purposes of the HBI, where do these terms come from and what do they mean?

The HBI acknowledged relying heavily in its formation on an extensive literature review provided by a separate previous initiative from the National Institutes of Health called the Cognitive and Emotional Health Project (CEHP), which was just writing up its findings in 2006.[81] The CEHP was an information gathering effort among three NIH institutes – the National Institute on Aging, the National Institute of Mental Health, and the National Institute of Neurological Disorders and Stroke – to examine research that had been done on maintaining or developing healthy brain function (both cognitive and emotional). Some of the members of the HBI team had also been involved in the CEHP and gave its members access to the literature review before publication. As Dr.

[81] "The ground work for The Healthy Brain Initiative emanated from a critical analysis of the scientific literature in 2001, the Cognitive and Emotional Health Project (CEHP), sponsored by the National Institutes of Health." Centers for Disease Control and Prevention. *The CDC Healthy Brain Initiative: Progress 2006-2011* (Atlanta, GA: Centers for Disease Control and Prevention, 2011), 3.

Anderson stated, the CEHP "framed our [research] meeting and it framed the whole *Road Map*."[82]

The CEHP report opened with a discussion of *cognitive health*, which "should be defined not just as the absence of disease, but rather as the development and preservation of the multidimensional cognitive structure that allows the older adult to maintain social connectedness, an ongoing sense of purpose, and the abilities to function independently, to permit functional recovery from illness or injury, and to cope with residual functional deficits."[83] Several things are notable about this definition. First, it echoes the World Health Organization (WHO)'s 1948 definition of health in general as "more than the absence of disease" and suggests that it goes beyond even "preservation" to include the possibility of ongoing "development." Second, the definition is evokes the WHO's biopsychosocial International Classification of Functioning, Disability, and Health (ICF) framework, in which the outcomes are functional rather than just physical or clinical. The CEHP report defines *cognitive function* as "social connectedness" and "the abilities to function independently," "ongoing sense of purpose," and a kind of resiliency in the face of illness or disability. The last aspect mentioned, which "allows the older adult to maintain ...the abilities...to cope with residual functional deficits" evokes compensatory processes, suggesting that even structural problems resulting in functional deficits may have workarounds that enable continued functioning in society.

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[82] Lynda Anderson, interview by author, Atlanta, GA, November 21, 2011.
[83] Ibid., 13.

Backing the claim that we can define cognitive health as an achievable health goal is evidence that function can trump structure even in the case of disease or cognitive aging processes. That is, there appear to be accessible health resources that operate against disease. What ultimately matters is the functional outcome, which is positive or acceptable when the health resources are enough greater than the disease to provide functional workarounds. The authors write:

> Cognitive reserve has been proposed as a mechanism to explain why some individuals may not exhibit the clinical manifestations of dementia while other individuals do with the same load of brain pathology. Cognitive reserve as measured, for example, by general intelligence, has been associated with higher occupational attainment and education as well as increased participation in intellectual, social, and physical activities. These observational findings suggest implementation of alternative or complementary strategies for reducing risk for dementia.[84]

The idea of cognitive reserve is grounded in both quantitative and qualitative assessments of brain functioning. The example of "general intelligence" may be considered mutable or immutable, but the authors seem to take the view that intelligence can be modified and is just one of a number of possible forms of reserve that can compensate for "functional deficits." Where some researchers have pointed to brain size, which suggests innate, genetic, or essential features, most point to education as a form of development that can either stimulate brain development in the form of increased number of dendrites and synapses (quantitative) or also stimulate multiple alternative overlapping patterns of thought that can serve to solve problems. As the CEHP authors indicate, individuals with the same level of pathology may be affected quite differently. What could explain such a phenomenon? The reliance on slightly different brain

[84] Hendrie et al., *CEHP Report*, 13.

circuitries in those people with highly developed cognitive reserve is thought to make workarounds possible in the case of pathology.[85] As the authors indicate, the theory of cognitive reserve suggests new forms of intervention to promote reserve as a health enhancing measure. While this approach may not prevent disease it probably allows an adequate level of coping that may result in successful cognitive aging.

The review stated its preference for positive *cognitive health outcomes*. These desired outcomes are also functional: "To address the concept of the preservation and promotion of cognitive and emotional health, the committee decided to focus its review on cognitive outcomes such as cognitive performance and cognitive decline, rather than clinically defined outcomes, such as dementia, mild cognitive impairment, and AD."[86] In the context of their discussion of function, the authors use the term "cognitive performance" as an outcome of functioning well (i.e., independently) and "cognitive decline" as an outcome of functioning poorly.

Despite clarity on what outcomes the group was looking for, however, it was difficult to find these outcomes. Indeed, the group mentioned only two studies in relation to cognitive health. One was the MacArthur Studies of Successful Aging

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[85] Yaakov Stern organizes the literature by distinguishing between active and passive models of reserve. For a good recent summary, see Adam M. Brickman, Karen L. Siedlecki, and Yaakov Stern, "Cognitive and Brain Reserve," in ed. Colin A. Depp and Dilip V. Jeste, *Successful Cognitive and Emotional Aging* (Washington, DC: American Psychiatric Publishing, Inc., 2010): 157-172. Regarding passive models of reserve, animal and human studies indicate that exercise improves brain structure directly by increasing grey and white matter volumes, angiogenesis, increased perfusion, and perhaps by modifying catecholaminergic or monoaminergic neurotransmitters (160). In contrast active forms of reserve are speculated to involve more effortful processes such as neural reserve or neural compensation (162), processes that are supported by evidence that with disease and age more brain areas are activated to complete a task (166).

[86] Hendrie et al., *CEHP Report*, 15.

(specifically, the Established Populations for Epidemiologic Studies of the Elderly, or EPESE) which found education, strenuous activity, peak pulmonary expiratory flow rate, and self-efficacy to be predictors of cognitive health in a community-based longitudinal study of older adults in their 70s.[87] That study used a battery of five neuropsychological tests to measure cognitive function change from baseline to a followup 2.0 to 2.5 years later. The other research study was the Advanced Cognitive Training for Independent and Vital Elderly study (the ACTIVE Trial), the largest relevant randomized controlled trial to date on cognitive training interventions.[88] The latter used a combination of neuropsychological tests in the areas of intervention, self-rated difficulty on Instrumental Activities of Daily Living, and everyday speed of processing and everyday problem solving. It found durable cognitive training effects five years after intervention and better performance on IADL difficulty for the reasoning intervention group. We will discuss this study at greater length in the next chapter.

Most of the evidence presented in the review, according to the authors, had to be extrapolated from negative health outcomes. The lack of positive outcomes across studies led the authors to recommend that "The research community should ... pursue the avenue of brain health maintenance with as much vigor as is

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[87] Marilyn S. Albert, Kenneth Jones, Cary R. Savage, Lisa Berkman, Theresa Seeman, Dan Blazer, and John Rowe, "Predictors of Cognitive Change in Older Persons: MacArthur Studies of Successful Aging," *Psychology and Aging* 10, no. 4 (1995): 578–89.

[88] Karlene Ball, Daniel B. Berch, Karin F. Helmers Jared B. Jobe, Mary D. Leveck, Michael Marsiske, John N. Morris, George W. Rebok, David M. Smith, Sharon L. Tennstedt, Frederick W. Unverzagt, and Sherry L. Willis, "Effects of Cognitive Training Interventions with Older Adults: A Randomized Controlled Trial," *JAMA* 288, no. 18 (November 2002):2271– 81.

brought to the quest to understand the pathophysiology of brain disease...." [89] The Committee used a rigorous standard to evaluate findings. It selected longitudinal studies that were large-scale (500+ participants), involved people age 65 and up, and included at least a memory cognitive variable. A loose set of positive associations included higher education levels, higher socioeconomic status, emotional support, more physical exercise, better lung capacity, moderate alcohol use, and use of vitamin supplements. A set of negative associations included hypertension, diabetes, stroke, or transient ischemic attacks, presence of white matter lesions or infarcts on brain images, low mood, and higher body mass index. To turn these to positive findings would be based on an assumption that removing a risk factor would enhance health.[90] Resigned to having to perform extrapolation, the authors note that "research that focuses on preserving cognition and emotion may well identify a different set or combination of risk factors and thus different prevention strategies than would research on single disease outcomes.[91]

Following in its footsteps, the HBI adopted the same language as the CEHP: the terms cognitive health, cognitive outcomes, cognitive function, cognitive performance, and cognitive decline. However, the *Road Map* elaborated on cognitive functioning to state that it included the following neuropsychological components: language, thought, memory, executive function, judgment, attention, perception, remembered skills (e.g., driving), and the ability to lead a

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[89] Hendrie et al., *CEHP Report*, 26.

[90] Ingmar Skoog, "Commentary on 'The NIH Cognitive and Emotional Health Project: Report of the Critical Evaluation Study Committee,'" *Alzheimer's & Dementia* 2, no. 2 (2006): 89-90.

[91] Hendrie et al., *CEHP Report*, 26.

purposeful life.[92] Other differences between the two projects are apparent in the following passage from the *Road Map*:

> Much like physical health, cognitive health can be viewed along a continuum—from optimal functioning to mild cognitive impairment to severe dementia. It is not simply the absence of diseases such as Alzheimer's disease; rather, it should be respected for its multidimensional nature, and the changes that take place over the life span should be accepted, even embraced, as a natural part of the aging process.
>
> Cognitive decline can range from mild cognitive impairment to dementia, but these two conditions are not necessarily manifestations of the same disease. Many people never develop any serious decline in their cognitive performance, and those who develop mild cognitive problems do not necessarily develop dementia. Although not all people with cognitive decline develop dementia, those with an amnestic form of mild cognitive impairment do have a much higher risk for dementia than other adults.
>
> The lack of cognitive health can have profound implications for a person's physical health. Older adults and others experiencing cognitive impairment may be unable to care for themselves or to engage in necessary activities of daily living, such as preparing meals or managing their finances. Limitations in the ability to effectively manage medications and existing medical conditions are of particular concern when a person is experiencing cognitive impairment or dementia.
>
> Dementia affects a person's ability to comprehend and act on messages, and involves problems with memory, understanding or using words, and identifying objects. The significantly impaired cognition associated with dementia leads to a loss of sense of self and of lifelong memories; a decreasing ability to cope with the normal demands of living; problems accessing health care systems; greater vulnerability to disease, injury, malnutrition, crime, and possibly abuse; and eventually a loss of independence. That loss of independence becomes a burden on families and society, as the individual requires more intense care and often institutionalization. In the later stages, the cognitive impairment associated with dementia will create total dependency, and Alzheimer's disease is now ranked as the 8th-leading cause of death.[93]

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[92] CDC and AA, *Road Map*, 6.
[93] Ibid., 6-7

In this passage the *Road Map* tried to put cognitive health into the larger context of the life course and disease perspectives by introducing the idea of a functional continuum that ranges from optimal health, on the one hand, to severe dementia, on the other. The text suggests that "mild cognitive impairment" and "dementia" are both disease but may not be the same disease. Here we see the concept of successful aging invoked again, asserting that cognitive decline is not a normal part of aging and that aging can be disease and disability free. However, the preceding paragraph indicates that there will be age-related changes. It is unclear how age-related changes differ from decline and where they might fall on the continuum. The text also introduces the significance of cognitive problems in terms of their effect on physical health ("profound implications for a person's physical health"), the traditional domain of public health. Thus, it is the inability to take medications properly or adhere to other medical advice, use the healthcare system, or take care of activities of daily living that are functional consequences of cognitive decline and presumably the ability to perform these functions that indicate cognitive health.

Another difference of the *Road Map* is that it did not make reference to the research involving positive outcomes as in the CEHP report (EPESE or ACTIVE). Out of the research presented in the CEHP report, the HBI group focused on promising associations between vascular risk factors and cognitive health and between physical activity and cognitive health. The cardiovascular link was deemed to be the strongest evidence in the CEHP report, suggesting that diet, smoking, physical activity, alcohol intake, and sleeping habits could be modified to reduce risk of both cardiovascular disease and dementia. We will explore the

associations between vascular and cognitive health more with the research in the next chapter.

The Road to Cognitive Health

Another answer to the research question *Why have no public health recommendations been issued nationally for older Americans to maintain or promote their cognitive health?* is that the public health effort for cognitive health emerges from four relatively new areas of professional practice. These fields, health promotion, successful aging, evidence-based practice, and cognitive health in aging are dynamic and do not have clear agreed-on standards of practice. Evidence-based practice is closest to standardization with its systematic reviews and randomized control practices. But how evidence-based practice can complement the other fields most effectively is still not clear. The field of cognitive health in aging has a clear need to define its terms, its measures, and its theories. The difference between cognitive health and cognitive disease may not be as urgently in need of distinguishing if the functional outcomes of interest are clearly defined. If the outcome is function, at some level it may not matter how much disease is present but how much behavior can compensate or circumvent that disease. What matters is whether people can go about their everyday lives.

One promising theme traced throughout the fields that was not seized upon by the HBI was the conceptualization of cognitive health as a potential or as reserves. The *Road Map* did not include a discussion of cognitive reserve, a concept that is frequently used to underlie cognitive health promotion activities. The construct suggests a powerful theoretical guide to policy and practice that

was missed by the HBI. The idea of cognitive reserve brings together three of the four intellectual traditions used by the HBI. It complements Fries' compression of morbidity hypothesis, which states that delaying the manifestation of disease, even if the disease is present, can effectively compress morbidity and societal burden. It also complements Breslow's concept of health promotion as the promotion of health potential and health reserves. It further fits with the Baltes and Baltes model of successful aging that works with latent reserve within individuals to compensate for age-related deficits.[94]

The Healthy Brain Initiative's *Road Map* argued broadly that "public health should step forward to address cognitive health," and it initiated the process of evaluating evidence to recommend behavior change for cognitive health. It prioritized a subset of evidence for examination. This first chapter examined the disciplinary contexts out of which the main national program devoted to promoting cognitive health in older adults, the HBI, emerged. In the next chapter, we will look at research and researcher arguments for and against recommending behavior modification.

[94] Out of the four fields that shaped it, the HBI appeared to be most influenced by the idea of evidence-based practice, an undefined concept of health promotion, the Rowe & Kahn model of successful aging and its derivatives rather than the Baltes and Baltes model, and ideas from the field of cognitive health on how cognitive decline might impact physical health outcomes.

Chapter 2

Researching cognitive health

Two recent influential papers from prominent psychologists illustrate the debate over whether to issue public health recommendations related to cognitive health and work to introduce the dialogue among the researchers interviewed in this project. The divergent conclusions drawn by these scholars are based on a use of different types of evidence, but perhaps more importantly, on different warrants linking the evidence to the policy claims. The same can be said for the researchers interviewed in this project, helping us arrive at what is at stake in these differing conclusions for public policy. Ultimately it seems that reading the evidence in an interdisciplinary fashion is required to endorse public health recommendations for cognitive health. As the opening debate and subsequent interviews show, remaining within strict disciplinary boundaries cannot move public health forward or meet its moral imperative to alleviate suffering. Among the researchers' arguments presented in the pages that follow, the most compelling seems to be *The Logically Derived Argument*, which shows how established evidence for cardiovascular health can be extended to apply to the

cardiovascular sequela of cognitive health. Extending existing policy based on this evidence is both important and feasible due to the urgency surrounding the prevalence of cognitive decline amid population aging. This chapter begins with arguments that touch on the messy subject of cognitive engagement and end with those that more neatly address the connections between vascular and cognitive health.

In 2006, Dr. Timothy Salthouse of the University of Virginia took on the issue of the benefits of mental activity in an article titled "Mental Exercise and Mental Aging: Evaluating the Validity of the 'Use It or Lose It' Hypothesis."[1] Salthouse is a towering figure in the field of cognitive psychology, having documented "robust" cognitive performance declines in aging and having proposed the processing speed theory of cognitive aging as a common cause explanation.[2] His article depicts the *use it or lose it hypothesis*, the idea that mental activity can preserve mental functioning in aging, as a generally accepted folk theory that has little empirical support.[3] The popularity of the theory, he says, is supported by "a plethora of anecdotal observations, what seems to be a compelling analogy to the effects of physical exercise on physical functioning, and a commitment to the assumption that humans can exert control over their own destiny by choice of lifestyle."[4]

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[1] *Perspectives on Psychological Science* 1, no. 1 (2006): 68-87.

[2] See, for example, Arthur F. Kramer, Louis Bherer, Stanley J. Colcomb, Willie Dong, and William T. Greenough, "Environmental Influences on Cognitive and Brain Plasticity during Aging," *The Journals of Gerontology* 59A, no. 9 (2004): 940-941.

[3] Salthouse, 2006. In this article Salthouse attributed the first reference of the concept in the field of cognitive aging to Josephine Curtis Foster & Grace A. Taylor in 1920. See "The Applicability of Mental Tests to Persons over 50," *Journal of Applied Psychology* 4, No. 1 (March 1920): 39-58.

[4] Salthouse, 2006, 84.

Salthouse reviews evidence for the claim that "the rate of mental aging is moderated by amount of mental activity," including training interventions, rates of aging of experts in particular domains (e.g., chess) and occupational groups (e.g., professors) and leisure activities (e.g., crossword puzzles) and found that the trajectories of growth and decline in cognitive abilities represent the same curvilinear shape. After usefully pointing to many methodological problems in this field of study, Salthouse summarizes the evidence to argue against the *use it or lose it hypothesis* because the variables of activity and aging do not interact to change the shape of decline. In other words, all people have worse performance in old age no matter how much time they have spent acquiring skills or experience. However, Salthouse seems to favor an overly constrained interpretation of the *use it or lose it* hypothesis by claiming that behavior must change rate of aging. He himself admits at the end of his article that enhancing skill or ability earlier in life may have the net effect of delaying the manifestation of decline later in life. Although he does not use the term, this possibility is a restatement of Fries *compression of morbidity* hypothesis and a central tenet of health promotion in aging. The point is, who really cares about the academic finding that the rate of aging occurs universally and is the same across people, if the real effect is that cognitively engaged people have more years of cognitive functioning because they have built up higher skill level?[5] If the latter is true we need to encourage mental activity through public health action.

[5] Interestingly, Salthouse is eloquent in advising cognitive engagement anyway, concluding his article with the statement that "Although my professional opinion is that at the present time the mental-exercise hypothesis is more of an optimistic hope than an empirical reality, my personal recommendation is that people should behave as though it were true. That is, people should continue to engage in mentally stimulating activities because even if there is not yet

Hertzog, Kramer, Wilson, and Lindenberger (2004)[6] respond directly to Salthouse, but they broaden their focus from mental exercise and the *use it or lose it hypothesis* to what they call the *cognitive-enrichment hypothesis*, which looks at all behaviors that can potentially affect cognitive functioning in old age including cognitive, social, and physical engagement.[7] Their broadened claim is that "a variety of factors, including engaging in intellectually and mentally stimulating activities, both (a) slow rates of cognitive aging and (b) enhance levels of cognitive functioning in later life." Claim (b) shifts the argument into dialogue with public health concerns and the desire to promote the compression of morbidity rather than rate of aging *per se*. The argument alludes to the Baltes and Baltes successful aging model[8] by discussing ranges of developmental abilities throughout life, both plasticity and restricted potential with age, selectivity of activity throughout the life course that affects abilities, and the ability for knowledge (pragmatics) to compensate for process declines (mechanics) in age.

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evidence that it has beneficial effects in slowing the rate of age-related decline in cognitive functioning, there is no evidence that it has any harmful effects, the activities are often enjoyable and thus may contribute to a higher quality of life, and engagement in cognitively demanding activities serves as an existence proof – if you can still do it, then you know that you have not yet lost it," ibid., 84-85.

[6] Christopher Hertzog, Arthur F. Kramer, Robert S. Wilson, and Ulman Lindenberger, "Enrichment Effects on Adult Cognitive Development: Can the Functional Capacity of Older Adults be Preserved and Enhanced?" *Psychological Science in the Public Interest* 9, no. 1 (2009):1-65.

[7] Ibid, 3: "Thus, rather than speaking of cognitive use or cognitive exercise, we generically refer to all behaviors that potentially enhance cognition as forms of cognitive enrichment. The cognitive-enrichment hypothesis states that the behaviors of an individual (including cognitive activity, social engagement, exercise, and other behaviors) have a meaningful positive impact on the level of effective cognitive functioning in old age. We subsume the use-it-or-lose-it hypothesis under this more general cognitive-enrichment umbrella."

[8] Paul B. Baltes and Margret M. Baltes, "Psychological Perspectives on Successful Aging: The Model of Selective Optimization with Compensation," in ed. Paul B. Baltes and Margret M. Baltes, *Successful Aging: Perspectives from the Behavioral Sciences* (Cambridge: Cambridge University Press, 1990), 1-34.

These researchers state that one of the main reasons their conclusions differ from those of Salthouse is that they include longitudinal studies whereas he does not, and "[t]o ignore this longitudinal evidence is to discount some of the strongest evidence for cognitive-enrichment effects."[9] It must be noted that by including longitudinal evidence these researchers are reaching across traditional disciplinary lines to include epidemiological data that has traditionally been the purview of public health rather than cognitive psychology. This interdisciplinary approach, they demonstrate, changes one's conclusions. They examine longitudinal data associating mental activity, physical activity, and social activity in adulthood with later onset of cognitive dysfunction, skill training with transfer effects on attention and other areas of executive functioning that are particularly vulnerable to cognitive aging, and aerobic training effects on executive functioning, to name a few. The authors call evidence accumulated since 2000 that aerobic exercise enhances cognitive function in older adults "overwhelming." Notice, again, that the emphasis is placed on enhancement rather than on slowing cognitive aging. This perspective dovetails with the neuropsychological concept of building cognitive reserve for longer cognitive functioning.

I will examine some of the evidence for cognitive effects later in this chapter but for now let us look at how Hertzog et al. connect the evidence to their claim. They do it as follows:

> Given the problems associated with assessment of change over long time intervals (years or even decades, in the case of the cognitive-enrichment hypothesis), developmental researchers must consider evidence from multiple, different observational and intervention designs. The sources of evidence range from cross-

[9] Hertzog et al., "Enrichment Effects on Adult Cognitive Development," 41.

> sectional associations, longitudinal panel studies, experimental intervention in human and animal populations, and neuroimaging studies to computational models. The characteristics of each of these different approaches – their strengths and weaknesses regarding the enrichment process – need to be taken into account as one is attempting to identify the mechanisms and estimate the possible amount of cognitive-enrichment effects in human cognition.[10]

The passage above endorses the interdisciplinary method of triangulation.[11] Through triangulation, researchers acknowledge that each type of evidence has its own weakness. By pooling data together in examination of the same research question, researchers using this approach attempt to come up with a more complete answer than if they looked at one data stream alone. This is a very different perspective than the sequential process endorsed by the *Evidence-Based Policy Argument*, where observational studies lead to clinical trials, which lead to policy. In backing this interdisciplinary warrant, the researchers later allude to a public health crisis, with "staggering health care costs in the United States." In addition, they suggest that public opinion has left public policy behind because "our society is proceeding forward as if the case [i.e., that cognitive enrichment benefits cognitive functioning] is closed, and public policy will need to understand that reality and attend to it."[12] By this they mean that companies marketing cognitive products with health claims are economically thriving. They draw parallels with health campaigns that have changed behavior for societal benefit: "Public campaigns have raised public awareness about the risks of tobacco consumption and have influenced its use, and similar efforts may lead to

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[10] Ibid., 10-11.

[11] See Norman Denzin's description of this social science research method, "Strategies of Multiple Triangulation," in *The Research Act* (Chicago: Aldine Publishing Company, 1970): 297-313.

[12] Hertzog et al., "Enrichment Effects on Adult Cognitive Development," 48.

better fitness, more active engagement in life, and so on, with derivative benefits,"[13] further developing their moral backing for change.

In my reading, the article endorses public health messaging. Although behavior may not necessarily change the rate of aging, it can have other public benefits and for this reason recommendations for these behaviors could be issued. The authors write, "Our point has been that enrichment effects can have positive benefits even when they do not address the underlying cause of incipient cognitive decline. For instance, physical activity can delay the onset of cognitive loss associated with dementia and normal aging."[14] Such delay, representing a compression of morbidity, would translate to enormous public health savings in terms of prevented institutionalization. The authors even note that pointing out the connection between longer community residence and an active lifestyle could be used to motivate the public to engage in these healthful behaviors.[15] Lastly, the authors point out that behaviors cannot guarantee outcomes because the evidence only guides us "on a probabilistic basis,"[16] a comment that seems to sum up the limitations of all evidence in relation to any public health, or even clinical issue.

The debate between Salthouse and Hertzog et al. illustrates how cognition can be framed differently in relation to public health. Whereas Salthouse stayed within the disciplinary purview of cognitive psychology and took a focused view of a tight hypothesis, in my view Herzog et al. used a moral imperative to broaden the issue in public health terms, raising the stakes and also raising questions

[13] Ibid., 48-49.
[14] Ibid.
[15] Ibid., 47.
[16] Ibid., 49.

about the types of evidence that should be called on to answer the question, *What public health recommendations can be made to promote cognitive health in aging?* I begin the discussion of arguments for public health recommendations by describing the trials that constitute the main support for evidence-based practice built around cognitive engagement.

The ACTIVE and IMPACT Trials

Cognitive engagement has a dubious place among lifestyle interventions for cognitive health. A large public health review of evidence on brain aging and the prevention of dementia did not even bring up the subject.[17] Cognitive engagement encompasses leisure activities that are considered to be cognitively demanding as well as cognitive training exercises, which are usually targeted practice exercises in cognitive tasks to develop particular abilities. Interventions range from pairing elders with children in elementary schools for mutual cognitive stimulation as in the well-known Baltimore-based Experience Corps to computer-based cognitive fitness training. The most cited intervention with applicability to public health is the Advanced Cognitive Training for Independent and Vital Elderly study, or the ACTIVE Trial. Because it is the largest and most comprehensive of RCTs to date, with claims to impressive benefits lasting five years, examining the evidence found in ACTIVE is a useful focus for our cognitive engagement discussion.

ACTIVE

[17] Mary N. Haan and Robert Wallace, "Can Dementia Be Prevented? Brain Aging in a Population-Based Context," *Annual Review of Public Health* 25 (2004):1-24.

Funded by the National Institute on Aging and the National Institute of Nursing Research from the year 2000, ACTIVE enrolled 2,802 community-dwelling adults aged 65 and up who had no significant impairments. Participants were randomly assigned to one of three cognitive training interventions or a control group. They received either memory training (mnemonic strategies for remembering verbal material), reasoning training (strategies for identifying serial patterns in letter or word lists), or speed of information processing (computerized visual search under divided attention conditions), or nothing (controls). Participants were not blinded to their conditions although assessors were. The interventions were carried out in ten 60-75-minute group sessions over a 5-6 week period. The study looked at two sets of outcomes. First, it measured cognitive or "proximal" outcomes, which were neuropsychological tests in the areas of intervention: verbal memory tests, a pen and pencil pattern identification task, and a computer-administered visual identification test. Second, the study examined a set of four "primary outcomes" that were functional in nature and had been correlated with the trained abilities as well as with recognized public health goals such as keeping elders out of institutions. First, participants report their self-rated difficulty on a standard set of instrumental activities of daily living (IADLs) from the Minimum Data Set – Home Care that are known to be cognitively demanding, such as managing finances or using medication. The study authors call this outcome "IADL Difficulty" and they refer to it as an index of dependency because those who performed badly on many such activities often need to be placed under someone else's care. They were also rated on two performance measures. First,

participants were evaluated on “Everyday problem solving,” which required them to identify information in printed materials and perform behaviors with the information, such as making change. Second, participants were evaluated on “Everyday Speed of Processing,” which required them to perform activities such as looking up phone numbers or to perform reaction time tasks. In an attempt to investigate an effective “dose” of the intervention, the researchers further randomized a subset of participants of the training sessions to receive “booster” training at 11 and 35 months after initial training with four 75-minute sessions.

The first study report that occurred two years after baseline testing revealed that cognitive training had significant proximal effects under all three intervention conditions: memory training had boosted memory performance, reasoning training reasoning performance, and speed of processing training processing speed. These gains are consistent with much other research observing cognitive training effects. These gains remained for the first two years of follow-up, but decreased with time. None of the conditions, however, had any effect on the primary functional outcomes. Cognitive training, therefore, did not “transfer” to real-world tasks. The investigators did not expect transfer for a variety of reasons and had prepared to do a long-term study. One reason was that many participants were performing well initially and had no room to improve over a short period of time. Another was that they were not old enough to have experienced age-related cognitive decline, a factor that was clear by lack of

cognitive decline in the control group which could be compared to the potential stability or gains in the intervention groups.[18]

Three years later, a landmark article on the study was published reporting on results five years after baseline testing. Of the original participants, 67% were still with the study and due to attrition of the worse off represented a comparatively healthier group. Five years out, the immediate improvements in proximal abilities were still higher than controls, suggesting durable cognitive training effects. Those who received the speed-of-processing booster and the reasoning booster held onto their improvements in their respective abilities five years out better than those who had not received the booster. The effect size for the speed of processing intervention on speed of processing performance was 0.76 (0.62 to 0.90), versus effect sizes of 0.23 (0.11 to 0.35) and 0.26 (0.17 to 0.35) for memory training and reasoning training, respectively, on their corresponding performances. The effect of the speed of processing intervention was even greater with booster training, at 0.85 (0.61 to 1.09). The authors define this effect size in terms of training improvement from pre-training to year 5 minus the control's improvement during the same period, divided by intra-subject standard deviation on adjusted composite scores.[19] On the more important functional measures (i.e., how the cognitive training transferred to

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[18] Karlene Ball, Daniel B. Berch, Karin F. Helmers, Jared B. Jobe, Mary D. Leveck, Michael Marsiske, John N. Morris, George W. Rebok, David M. Smith, Sharon L. Tennstedt, Frederick W. Unverzagt, Sherry L. Willis, for the ACTIVE Study Group, "Effects of Cognitive Training Interventions with Older Adults: A Randomized Controlled Trial," *JAMA* 288, no. 18 (2002): 2271-81.

[19] Sherry L. Willis, Sharon L. Tennstedt, Michael Marsiske, Karlene Ball, Jeffrey Elias, Kathy Mann Koepke, John N. Morris, George W. Rebok, Frederick W. Unverzagt, Anne M. Stoddard, and Elizabeth Wright, "Long-Term Effects of Cognitive Training on Everyday Functional Outcomes in Older Adults," *JAMA* 296, no. 23 (2006): 2811.

everyday living), the reasoning training group (serial pattern training) had a significant effect of 0.29 (0.03 to 0.55) on self-reported IADL Difficulty, encompassing tasks such as preparing food and were observed to perform them better than they would have had they not received the intervention. The study also found reported decline in IADLs for the other two intervention groups that did not reach significance but had similar effect sizes. After controlling for baseline age and cognitive function, participants in the speed of processing group that had received booster training were 30% better at performance on everyday speed of processing than those who hadn't received booster training.[20] It is important to note that these "improvements" seem to be decreases in declines, suggesting better maintenance of health versus any improvement.

The ACTIVE Trial could be a useful model for public health intervention because it is built around sample means rather than individual scores. In addition, it specifically addresses the potential population aging issue of expected age-related cognitive decline (age-graded norms) and ways to cancel out those declines with gains.[21] However, the measurements used and their units are not adequately explained in the published articles to allow the reader to evaluate the meaning of the effect sizes. The authors admit that their finding that cognitive training had an effect on daily functioning is "limited,"[22] but they expect greater results with further follow up. There were also a number of other limitations. Recruitment could have led to a self-selecting group of better performing elders and therefore not be representative of most American elders. In addition,

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[20] Ibid., 2812.
[21] Ball et al., 2002, 2278.
[22] Willis et al., 2006, 2812. The study is ongoing.

analysis of attrition throughout the study showed that those remaining in the study tended to be better performers across all experimental groups. This is a problem common to many studies, as it is a challenge to attract a diverse group of participants and also sustain their participation. The difficulty here may be because cognitive function testing is perceived as more personally invasive or more burdensome than physical function testing. This study was single-blind, so that the participants knew the condition to which they were assigned, although the researchers did not. Participants may have been influenced by their attitudes and beliefs about the condition to which they were assigned. Finally, the lead author of the original study and a participant in the second study, Dr. Karlene Ball of the Center for Research on Applied Gerontology at the University of Alabama Birmingham, owned an interest in Visual Awareness Inc., the company that makes the Useful Field of View, the speed-of-processing assessment tool used. This potential conflict of interest raises the possibility of additional bias in the study.

The ACTIVE Study presents weak evidence that cognitive training improves cognitive functioning. The finding that reasoning training transferred to reported activities of daily living needs to be verified by functional assessments beyond self-reports under unblinded conditions. If the other interventions, speed of processing and memory, were close to reaching significance on decline of IADLs as the authors indicate, that needs to be shown in the same way with larger samples. These results need to be duplicated for it to be convincingly claimed that cognitive training can reduce the types of functional declines that tend to lead to poor quality of life, need for care, and even institutionalization. As

the study continues, it would be helpful if functional IADL assessments could be added to the self-reports and those compared with age-graded norms.

IMPACT

ACTIVE was followed by the IMPACT Trial, which used the Useful Field of Review instrument that had boosted speed of visual processing in the ACTIVE Trial.[23] Funded by the cognitive fitness software producer Posit Science Corporation, IMPACT was a three-site study involving 487 people age 65 and up. Recruitment and selection were similar to the ACTIVE Trial (recruitment through advertisements and presentations and selected if they were age 65 and up without significant impairments). Participants were randomized into either an experimental group that used Posit Science's Brain Fitness Program (which included Useful Field of View) or an active control that received a computer-based program of factual information from disciplines such as history, art, and literature. The training programs lasted an hour each day, five days a week, for eight weeks (a total of 40 hours) and were therefore much more intensive than in the ACTIVE Trial. Unlike the ACTIVE Trial, participants as well as administrators were blinded to the conditions. The study's primary measure was an index score from six subtests for orally presented speech concerning memory and attention from the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Because Brain Fitness trains auditory processing speed and RBANS measures memory and attention performance, the researchers assert that a measurable improvement in this score would constitute

[23] Glenn E. Smith, Patricia Housen, Kristine Yaffe, Ronald Ruff, Robert F. Kennison, Henry W. Mahncke, and Elizabeth M. Zelinski, "A Cognitive Training Program Based on Principles of Brain Plasticity: Results from the Improvement in Memory with Plasticity-based Adaptive Cognitive Training (IMPACT) Study," *JAGS* 57, no. 4 (2009):594-603.

a transfer effect. In order to add more sensitivity to the findings and to pinpoint the source of any generalizability found in the RBANS score, investigators included seven secondary measures, a "directly trained measure of exercise performance derived from the experimental training processing speed exercise" (no details provided) as well as six neuropsychological measures that used orally presented speech (the Rey Auditory Verbal Learning Test (RAVLT), Rivermead Behavioral Memory Test (RBMT), and Wechsler Memory Scale (WMS-III). In addition, they administered a pre-post assessment on the Cognitive Self-Report Questionnaire CSRQ-25. Unlike in the ACTIVE Trial, evaluation took place at an unspecified time soon after recruitment, without a one-year, two-year, or five-year followup.[24]

The study found that mean performance on RBANS increased 3.9 points on average for the experimental training group, a significant 2.1 points higher than for the active control. Both groups started out very close to the ceiling of 100 points (96 points on average for the experimental training group and 96.6 for the active control), so the gain may be impressive. The authors had mentioned this ceiling as an explanation for why they recruited other secondary measures of memory and attention.

The study reported significantly larger mean improvements on all secondary measures except the Rivermead Behavioral Memory Test for the experimental testing group over the active controls: an average 60 millisecond greater drop in mean processing speed by the experimental training group which

[24] Ibid. It is due to this lack of followup that the IMPACT Study was not included in the State-of-the-Science review.

trained on that measure over the active control group, a 3.2-point better score in overall memory, a 2.2 better score on the total RAVLT a .6-point better score on the RAVLT word list delayed recall, a .5-point better score on the WES-III digit span backwards test, a .4-point better score on the WES-III letter-number sequencing test, and a .025 better score on the CSRQ-25 test.[25]

The experimental trial participants had an average drop in processing time of 68 milliseconds from a mean of 116 milliseconds (with huge standard deviation) to a mean of 48 milliseconds. These results are 60 milliseconds (.006 second) better than the improvements made by the active control group. While statistically significant at a p value of less than .001, the difference of 60 milliseconds between the active group and the controls represents an incomprehensibly small amount. The result would appear to be significant but substantively meaningless.

There are numerous problems with how the IMPACT study was reported in the published article.[26] The study reported that the Brain Fitness Program intervention training effects transferred from auditory processing speed to attention and memory tasks, a finding never before shown. This finding is based on the composite index score which the authors admit starts at close to the ceiling, with little room for improvement. The magnitude of improvement in other measures showing significantly better performance by the experimental group over the controls is difficult to interpret because the total possible scores are not provided. The study reported only change from mean baseline scores, not

[25] See Table 2, ibid. 599.
[26] Ibid.

specific neuropsychological scores by person or group, making it difficult to evaluate results. The range of possible scores on the scales was not provided. In addition, the IMPACT study population was less diverse than the ACTIVE group, with Caucasians comprising 93.8% of the experimental condition and 95.5% of the active control, and both groups were well educated. The authors themselves state that the study population may limit the generalizability of the results. The active intervention offered, instruction in fields such as "history, art, and literature" sound problematic on the face, appealing perhaps only to a small subsection of the population who would be interested in these school subjects and therefore as fully cognitively engaged in such an intervention as in a game-type computer activity. Lastly, as with the ACTIVE trial, the IMPACT trial showed conflicts of interest, as the study was sponsored by Posit Science Corporation and author Henry M. Mahncke owns Posit stock and had input into the study design. The article does state that the principal investigators were Drs. Smith and Zelinski who did not work or own stock in Posit Science, perhaps reducing any conflict of interest. In general the evidence for the IMPACT study appears to be very weak.

Cognitive Engagement for Cognitive Health

Now that evidence for cognitive engagement has been presented, we can look at arguments that make use of this evidence. Though quite familiar with the ACTIVE Trial, Dr. Leonard Poon of the University of Georgia did not endorse a message of cognitive engagement. Poon raised a number of problems with the

research to date from his vantage point as a cognitive aging psychologist. An excerpt from his interview follows:

Leonard Poon:

> ...[T]he finding is very robust and reliable that there are [age-related cognitive] changes. The changes are not uniform: some changes are positive, some are negative. The slope of change definitely varies across individuals. [For example,] your wisdom, your experience, your accumulation of experience, your crystallized intelligence – that goes up with age. We know, on the other side, your fluid intelligence does go down with age and there are many reasons and it may not be because of the brain. It could be lack of practice.... It's just that you haven't exercised those kinds of skills for a long time and all of the sudden you're confronted by someone asking you to perform those skills and immediately you can't get to it, but with a little bit of practice you can get back to your previous level. And so it doesn't have anything to do with the integrity of your brain but the context from which you're functioning....you may *lose interest* in these particular topics and therefore you're not up to date on it. But, on the other hand, you may be up to date on other areas that you should be able to perform at a high level because you've been in it for such a long time. And it is invariant of brain function.
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> Now the interesting thing about that study [ACTIVE], it really turns out that a lot of these techniques that purport to increase memory have very small effect sizes. And they also found, and it's confirmed in the literature, that there's lots of individual differences. Frequently, too, and this is not just jargon, the mean doesn't represent anyone. So I guess the issue is that when you talk about the aging brain and when you talk about cognition, you also need to talk about variability. And I think the study of variability perhaps is more important than the study of the phenomena median, mode, central tendency....Public health needs to be sensitive to individual variability, understanding the phenomena is such that it would not provide us with a simple definition. So I wouldn't say it would exclude public health, but public health has to understand that cognition you're talking about the mind and you're also talking about so many things that would influence the mind and your measurement frequently is indirect, you know, it's not like any treatment is so strong that you're going to get a very uniform response. But I think it's important for public health to understand the variability issue. I think it's a front and center issue.
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> ...[Evidence for lifestyle factors that can improve or maintain cognitive health,] I think it's really emerging. And it will probably be emerging as one of the key factors.... You know, for a long, long

time people would say if you exercise your brain there's a good chance that you could either delay or escape from having Alzheimer's and your so-called brain would be healthier. And there were two review papers that came from Tim Salthouse and Margie Gatz, saying that the evidence is just not there if you have proper control of this. It's more self-fulfilling prophecy, it's more that if you put in a lot of effort, it *must* be good for my brain and therefore it is good. But it is difficult to get evidence of increased efficacy mostly because of this variability issue. So the area of cognition and aging, under some circumstances, is fairly easy, you know, that there are certain factors that are good or not good for that, but the test of intervention is very difficult. You can use that person as his own baseline, and if you do it longitudinally, to make sure that you have replication longitudinally to see indeed what the variation is.

The technique that I have advocated for a long long time is...called allometric analysis that compares the slope to a baseline.... it's more experimental, it's laboratory-based and it's not practical for clinical evaluation....Physicians and others want a very simple thing [assessment tool], like the MMSE, and the MMSE doesn't really tell you too much. You could have a perfect MMSE and you can still be demented. That's true. Because the baseline of that person is so high, you get down to perfect because those items are so easy.... Cognition is not simple and if you want to have good diagnoses you have to spend time to do the diagnoses...There's a phenomenon called the complexity hypothesis and ... what the complexity hypothesis says is that when you increase complexity of task demand on both young people and old people, old people are disproportionately disadvantaged. And so when you are probing the performance of younger people, when you increase the complexity they get slower, they make more errors, so there's a slope. When you do the same thing to older people that slope is steeper. And that steeper slope could be estimated in normal aging. And then with pathology that slope increases.... I have done work that showed that in normal aging there is a statistically significant difference in slope in that older people are slowed by about 36%. And then I used the same measurement technique to take a look at what happened to both people who are demented but not depressed and depressed but not demented, and I got different slopes out of it.

...we do know that aging without disease shows different patterns of cognitive changes. And when you add pathology on top of that then the functioning would change because of the pathology. And it could be additive or multiplicative. So you have certain levels of change over time that are supposedly normal, and then when you have a stroke or whatever other things then you know that that would be on top of the normal changes. We don't know whether it's additive or multiplicative but certainly if you have pathology on top of the impact of time then you are certainly more

> disadvantaged. But there's lots of data sets that show that there are patterns of impact just due to time. And I think one can learn from those patterns and devise suggestions to delay those changes if at all possible.[27]

In interpreting this passage as an argument, we can deduce the claim that *We cannot yet issue public health recommendations for behavior change.* Dr. Poon provides many reasons for this claim. We do not have conclusive evidence because evidence for lifestyle factors such as cognitive engagement is still "emerging." Mainly, however, researchers do not even seem to agree on how to measure cognition. We are at a very preliminary stage of agreeing on research variables. His own proposal to measure individual slopes of change against normed slopes of change for different conditions remains "experimental."

In this discussion of measurement problems, Poon alludes to large disciplinary rifts between researchers. For example, there is a rift between psychology, an individual-based discipline, and public health, a population-focused discipline. We need to figure out how to separate cognitive factors from other psychological factors that have a bearing on individual "performance." To draw on the performance metaphor, two actors with healthy brains might respond differently to sound, with one forgetting his lines in a setting that is overly noisy and the other forgetting them in a setting that is unsettlingly silent and still. An ideal performance takes practice, motivation, and a sense of comfort in the performance setting and would have different requirements based on life history and on personality. An introvert, for example, might be threatened by a performance situation where many other people are present, and an extrovert

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[27] Leonard Poon, interview by author, Athens, GA, September 20, 2011.

might be motivated in a setting where there is someone important to impress. Each person has a range of abilities and performs better or worse based on the compatibility of the context. To say that a test performance *is* that person's cognition is problematic. Psychology has traditionally considered contextual factors around behavior that are highly individualized such as personality (introversion, extroversion, neuroticism, conscientiousness, interests, particular factors that stress an individual), history (for example, life experiences), functional capacity ("baseline" functioning, which perhaps might also be termed intelligence, rate of change with age, presence of pathology), and perhaps also beliefs and culture ("if you put in a lot of effort, it *must* be good for my brain"), in addition to age. Poon emphasizes that measurements need to be built around change in the individual.

Another disciplinary rift is between psychology and clinical medicine. Both, he suggests, "diagnose" people, but psychologists will go in depth whereas physicians want a simple quick tool to diagnose dementia – the Mini-Mental State Exam (MMSE) – which is not sensitive enough for a health-based discussion as we are talking about. Another major issue touched upon is the difference between age-related change in cognition and pathology. Since "the slopes" are different between young and old, we might ask whether the first issue, age-related change is considered an important health issue. How many people in their concern about "cognitive decline" are talking about "normal" age-related change and how many are talking about pathology? If they are talking about "normal" age-related change, does it mean that it is a non-issue because it is not "pathological"? Is normal age-related change also a public health issue today?

Poon suggests the warrant that RCTs alone can support public health messaging. As ACTIVE is an RCT that lacks impact, we are not ready to issue lifestyle recommendations *en masse* for behavior change. In examining the evidence, Dr. Poon noted that the effect sizes for ACTIVE were very small. Dr. Poon's second criticism of the ACTIVE study was that the study masked large individual differences in performance. In reading the results of this landmark article we are reading averages of all scores in the groups and how these means change over a five-year period. We do not see the actual test scores or absolute numbers, nor do we see a median, and skewness has been removed.[28] In examining the data through Dr. Poon's perspective of variability, it seems that improvements in the reporting of IADL difficulty in the Reasoning group have more to do with the greater intra-individual variability within the control group than in the intervention group. The absolute numbers from baseline to five year measurement suggest that the control group improved much more than the reasoning group (a decline in difficulty of 1.2 for the control group vs. 0.4 by the reasoning group) with starting difficulties higher for the reasoning group than the control group. Effect size is defined as training improvement from baseline to year 5 of the intervention group minus control improvement during the same period, divided by intrasubject standard deviation of the adjusted composite for the intervention group. Therefore, the significant result for the reasoning group seems to be coming from a smaller intrasubject variability number for this group. That in and of itself might be an interesting marker of uniform application in the reasoning intervention but it is a different finding from that reported in the

[28] Willis et al., 2006.

ACTIVE study article. Without the right measurements we cannot make public health recommendations. Dr. Poon stays close to the *Evidenced-Based Policy Argument* in stating that we are not ready to issue lifestyle recommendations for cognitive health.

George Rebok

Whereas Poon touched on the need to separate "normal" age-related change from contextual and pathological effects, Dr. George Rebok suggested that age-related change was an increasingly salient issue among the public and that this fact might play into conclusions one would draw based on evidence for lifestyle behavior for cognitive health. Below is an except from his interview:

> ...[C]ognitive impairment is a very prevalent problem for older adults. And I think we live in a more complex society these days too, so the premium placed on cognition and the new roles for older adults, the changing roles, has sort of amplified the importance of cognitive health, not just for older people but for people in general. Buzz Hunt in Washington writes about ... not being smart enough for society, that with technological advances, the rapid pace of change, that we are not going to have the cognitive skills to master it. As people work longer, there's questions about maintaining cognition to be able to fulfill work roles.... I've noticed in my own studies, when I first started out, when I'd advertise for a study on cognitive health I got very few takers and nowadays you advertise for something to do with cognitive health, particularly if it involves an intervention, and people are sort of lining up at your doorstep.
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> ...When we talk about cognitive health I think people are sort of looking for the magic bullet, they want *one* thing that they can do, if they can take *one* pill or they can do *one* crossword puzzle activity or they can sign up for one brain health program, or whatever it is, I think people are looking for a particular answer. And I guess I would suggest that, and I think it would be consistent with the HBI, that it really needs to be much more of a lifespan approach, it needs to be more curricularly based, that it's not going to boil down to one course or one training program or whatever – you think when you go to college you don't get just one course, you get a whole curriculum, and I think in cognitive health we need a curriculum of cognitive health. Most of these so-called

brain training programs last much less than a typical college course in terms of the dosage that you get and so I think one of the messages has to be that you need to start early, you shouldn't wait until you're 60 or 65, that it's got to be a lifelong process, you need to start thinking of early protective factors around diet and exercise and good healthy lifestyle management, and then thinking about it in terms of multiple things that you can do to maintain your cognitive health. It's not going to come down to doing just one mental exercise a day, just like you can't do just one physical exercise to be physically fit, it's got to be multifaceted.

...My sense was that there was really some evidence that's out there that was ignored or minimized in the final [State-of-the-Science Conference] report. There's a *huge* literature on cognitive training. We just completed a review on memory training going back to the 1960s and they're, just in the U.S. there are over 400 published articles on memory training and other aspects of cognitive training. There's a pretty substantial literature.... There was some mention of that evidence in there but I think, you know, that's been accumulating now for two, three decades and I didn't see any serious attempt made in that report to really look at that evidence....Everybody cites ACTIVE because that is sort of the gold standard in terms of cognitive training studies, but ACTIVE is certainly not the only training study that's ever been done, there's dozens and dozens....and I think the cumulative weight of the evidence, when you look even applying fairly stringent criteria, evidence-based criteria, still leads you in a somewhat different direction than in the consensus report.

... there's been skepticism about cognitive training and the degree of plasticity that exists. I think we place so much faith in pharmaceuticals and drug trials as going to provide sort of the answer here, and if you look at effect sizes, they're very small for drug trials, there's been a lot of failed drug trials, and I think that's another reason why I think there's much more interest in more behavioral kinds of approaches. But I think there's still skepticism about behaviorally based approaches that somehow don't involve some underlying physiological mechanism. I think for cognition it reflects sort of the medical view/model.

... I don't think the question is any longer if this stuff works. The answer to that is yes, it works. I think the more relevant question now is who does it work best for, under what circumstances does it work, for how long does it work, how can we introduce it into the population, even if we have these techniques how will they ever get injected into the population so that these procedures will become sort of institutionalized, really, within society. So we've got these programs out there but often seen as sort of gimmicks or the latest fad, people sometimes don't take this stuff seriously, you're selling me the latest memory trick,

> you're selling me this, you're telling me exercise is good or here's the fad diet, as long as I eat this I'm going to be cognitively healthy or whatever, so I think there's a lot of skepticism out there too.
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> ...[In terms of additional evidence,] There's the IMPACT study, Elizabeth Zelinski and colleagues, IMPACT study, and that's another fairly large scale clinical trial of interventions that are based on interventions that were used in ACTIVE, at least one that involved speed of processing which we found to be highly efficacious in ACTIVE. We're actually also doing a meta-review of computerized training programs for older adults, since that seems to be a new potential area for interventions. The number of studies is much smaller.
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> I think they're [the State-of-the-Science Statement is] behind the field here. I think the field has moved on. I think the questions are different than the questions they were raising.... There was a lot of disenchantment with the NIH report....I don't think we've really totally scraped the potential of the interventions. Most of the interventions we're talking about, like ACTIVE, are very short-term, limited interventions, you know, that are single ability focused or focused on a small number of abilities and so, what we're going to be seeing, I'm sure, in the future is more cross-training, sort of systems-level intervention where you combine like cognitive training with physical exercise with nutraceuticals with social engagement, doing models where we're actually combining - more of a curriculum kind of idea, getting back to what I said earlier, rather than thinking there is one cognitive training program focused on this ability is going to make a big difference, or we're going to do this for six weeks in the hopes that it will reverse a lifetime of health habits, and poor diet, and isolation.[29]

In this passage, Rebok claims that *We can recommend cognitive engagement to the public for their cognitive health*. This claim represents a general rather than specific message. For evidence Rebok mentions over 400 studies since the 1960s that he has reviewed. He mentions ACTIVE trial as the recognized "gold standard" clinical trial. Rebok also pointed to the less-cited IMPACT Trial. As one of the principal investigators for the ACTIVE trial, Dr. Rebok noted its impact and effects. Though citing both ACTIVE and IMPACT as evidence for the

[29] George Rebok, interview by author, Baltimore, August 11, 2011.

efficacy of cognitive training, Dr. Rebok also acknowledged that they were short-term, limited interventions that focused on single cognitive abilities at a time. He also suggests that evidence might need to come from studies on many different kinds of intervention studies because there is unlikely to be one behavioral "magic bullet."

Rebok's position that we are ready to encourage cognitive engagement based on the available evidence is supported by the warrant that the cumulative weight of evidence over time can suffice in the absence of more conclusive data. Rebok criticizes a more positivist paradigm that demands visual evidence of effect in noting the "skepticism about behaviorally based approaches that somehow don't involve some underlying physiological mechanism." Such a statement is probably a reference to cognitive reserve, which unlike brain reserve may refer to efficiency of brain usage (the brain's so-called software as opposed to the brain's so-called hardware).[30]

Rebok backs this warrant by pointing to a professional consensus with the words "I think they're [the State of the Science Conference Statement] behind the field here. I think the field has moved on." He also calls attention to the salience of the issue among the public as well as confusion around it.[31] In looking for a

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[30] See, for example, Yaakov Stern, "What Is Cognitive Reserve? Theory and Research Application of the Reserve Concept," *Journal of the International Neuropsychological Society 8* (2002): 448-460.

[31] Elsewhere in the interview, Rebok says, "I think people in general are confused now, the public in general is confused because they don't know who to really listen to, what the data are really telling us, should I do this, take this vitamin, or eat these foods, do this and your brain will stay happy. I think it's confusing, it's confusing for experts in the field to really know where the field's at. I can only imagine what it must be like if you have no background in this area and are listening to some show on cognitive health or are reading something in a popular magazine. There needs to be almost like a clearinghouse of not only just what works in terms of cognitive health promotion but what the public will accept." Ibid.

magic bullet, people are clearly impatient. In addition there is a need to use social capital that's accumulated, and has the potential to do a lot of good as it will encourage a generally healthy society whether it be through health behaviors or volunteerism.[32]

By pooling evidence across studies and even across behaviors (assuming that cognitive engagement would only account for part of the health effect because he too suggests that the effect sizes for each behavior may be too small to be the only thing one could do) we can meet some public demand while continuing to refine the message. Ultimately, in offering evidence for cognitive training, Dr. George Rebok uses a standard that is strikingly similar to Keith Tones's "judicial review,"[33] which was previously discussed in Chapter 1. Rebok presents a *Triangulated Evidence Policy Argument* in support of public health messages for behavior change.

Yaakov Stern

Dr. Yaakov Stern was the last interviewee to address the evidence available to support a public health message for cognitive engagement for cognitive health. An excerpt from his passage follows:

> ...I think that it's fair to say that epidemiology really supports the idea that there's a set of life exposures that seem to

[32] "I think cognitive health involves broader concepts in terms of things like societal engagement, civic engagement, that you're doing things that benefit society, more of an altruistic maybe kind of a focus, and I think that's one of the problems with a lot of interventions that are done to improve cognitive health, is that the focus is too narrow, on the individual, and that we appeal to people's fears about their declining memory or some other ability that may be declining as they grow older, and so it's very sort of individualistic, but I think we really need to think more at the population level, we need to think about cognitive health as maybe appeals to people wanting to see a better society, wanting to be remain engaged in society, wanting to give back to society. There are interventions that lead to sort of how do we create what I call and a lot of people call social capital in society, you know groups of people with sort of a collective sense of health and efficacy and the ability to really make a difference in the world." Ibid.

[33] Tones, "Evaluating health promotion."

promote, in my parlance, cognitive reserve and healthy aging. On the other hand, I don't think that we can give people a specific recipe/prescription with confidence. Let's put it this way. I don't think you can say, look, if you play Sudoku every night, or you take an adult course, or if you run and do crossword puzzles you're going to do better. I think anyone who says that with confidence is probably off-base. On the other hand, I think we can confidently say to people that it's good to exercise, how much, we'll see, it probably has the best evidence behind it. We can say to people it's good to remain cognitively engaged, it's good to remain socially engaged, it's good to remain active, but I don't think we're at the point where we can give people a specific recipe. That gets a little misleading.

But it's the zeitgeist now. ...Anyone you talk to, I'd say, above 55, above 50, probably, they're all, oh, I do crossword puzzles – they've all accepted it already that engaging in cognitively stimulating activities will help them...over the last few years there's just sort of become taken for granted that that's really true. And, you know, there's all these truisms, people go out there, well, really what's better is to do something you never did before, that's better than doing what you always do....or learn to juggle, or, you know, learn a new language. All of these things sort of sound good, but the evidence is really not there.

.... It's translating [the epidemiological evidence] into practice that's hard, more than just saying basically what I feel comfortable saying: It's good to exercise, it's good to remain active, it's good to be socially engaged.... Based on what we know from epidemiology. But I can't tell you oh, here's what's enough....[I can't say] [t]he dose, and I can't predict really the response. In general, we know it's good.

...I think in the end you need randomized trials. You know, you wouldn't accept any medication without them. That's sort of what we're talking about here. I think the problem is that it's easy to say that. They're very hard to design.... [I]t's very hard to define your outcomes in a meaningful way. Maybe some people are doing a better job than I am, but just looking at like cognitive testing, or neuropsych testing (pre/post), I don't think that's sufficient. And it's just hard when people are healthy, I think it's hard to effectively measure how well they're functioning. When someone has Alzheimer's it's easy to show that they have deficits in Activities of Daily Living or even early on Instrumental Activities of Daily Living, but in healthy aging we're talking about very different, subtle things. Not that the person can't drive, maybe they don't drive to unfamiliar places, you know, or maybe they don't drive at night, they're very subtle and they're very individualized and so I'm worried that we don't have optimal outcome measures.

> In the long term if you do very long term studies over several years, you could look at reducing the rate of cognitive decline, showing differential rates of cognitive decline. I think that would be compelling, but you know you need 45 years to do a study like that. It's very expensive. But you know like we did this study where we had people playing this very complex video game. They came in three times a week for 12 weeks –The Space Fortress. So they played it 36 times. It's a complicated game, and they have to coordinate a lot of stuff. We had very strong theoretical reasons for how we did it, and the kind of training that we used, and all of that, and in the end on my pre/post battery I showed that people who played the game learning it the way that I felt was most efficacious did a little better on some working memory task. But my colleague, who's a human factors guy, said, what kind of measure is that? You had them mastering this very demanding game that helped them improve their attentional allocation and their coordination of complex activities and goal setting, it's probably affecting their lives in ways that you don't even know how to capture....But, you know, I'm a neuropsychologist and in Alzheimer's trials it was easy, you could use a mental status test and it was good enough.
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> ... I still think there's a positive message there, and I do believe that it's true, but like I say I think more work needs to be done if you want to specify to people. I think it's fair to say that people who are more active, more socially engaged, more physically active, do better. We see it in study after study after study.... I think that it makes a difference....I really think it makes a difference.... but it's a very nuanced message.[34] You know, like I had a TV news station come to me and they told me that they wanted me to go around and give people crossword puzzles and tell them that if they do that every day, they'd age more successfully. I said, "You know, I can't say that." But people will. People do. So you just got to be careful about what you say.
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> I'm interested in cognitive reserve, I think it's a very hopeful message. I'm trying to understand how it works, what it is, and, you know, truthfully my stance for a long time was it was not time for me to do intervention studies because I don't understand the neural substrate of how reserve might work well enough to focus my intervention. But I've come around to the

[34] Yaakov Stern, interview by author, New York, NY, October 10, 2011. The full exchange was as follows: *YS: I think it's fair to say that people who are more active, more socially engaged, more physically active, do better. We see it in study after study. AV: Do better or are better? YS: Do better cognitively. Do better over time. AV: But does it just mean that they're already better? YS: No, I think that it makes a difference. AV: Ok. YS: I really think it makes a difference. AV: So that could be a message? YS: Yeah. But it's a very nuanced message.* I was probing Stern's potential message for his views on causality between life-style behaviors and cognitive health. From surrounding context I interpreted "nuanced" as meaning general.

> idea that you can take what you think is probably right and try it and understand that part of it.... like the simplest idea, like I used to say, when my daughter was learning seven plus six and having a hard time remembering thirteen, I said oh, do seven plus three plus three, that's how I do it, I do it by tens, right? A lot of us do that with math, we adapt our approach, you know we do things by fives, by tens, so I said that could be sort of like what reserve is, that you have multiple ways of attacking a problem, but to show that with imaging is very very difficult. You could do that experimentally. So we're working on different approaches to that.[35]

In the above passage Stern suggests the claim that *We can recommend cognitive engagement, social engagement, and physical engagement in general terms for cognitive health*. It sounds like a general prescription for good living but it is nevertheless a statement in the service of cognitive health that has not been endorsed by the NIH or the HBI to date. Stern offers no specifics, such as particular cognitive activity (crosswords puzzles being the quintessential example) or strategies (such as doing something you've never done before). He cannot even specify any particular exercise dose ("how much, we'll see"). It further sounds like he cannot even specify whether cognitive or social or exercise in isolation that would be effective. This can be inferred because he does not seem to endorse a message that "engaging in cognitively stimulating activities will help" but instead repeats the combination of behaviors as a composite. This is the most general message offered by any of the interviewees. But he does insist multiple times that it can be said.

The evidence that Stern points to many times is "compelling" epidemiological evidence and perhaps also available trials linking behavior with cognitive health in support of a general message ("We see it in study after study").

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[35] Ibid.

However, "in the end you need randomized controlled trials" to offer a specific "recipe/prescription," that is, "if you want to specify," which is clearly what people ultimately want. Stern mentioned ACTIVE as one of the first RCTs on lifestyle issues but did not endorse its findings. He and colleagues wrote elsewhere that "the lack of a significant general improvement in all domains of cognition suggests that the key to promoting cognitive flexibility may lie elsewhere. For example, it may be that training that promotes the use of flexible strategies for solving novel problems may confer the most benefits for cognition and function."[36]

Any more specific conclusions than Stern's general message will depend on the working out of measurements, especially establishing the outcomes that we are looking for. While Stern throws out some suggestions for outcomes, he also but makes clear that you could look at many behavioral realms and that it has not yet been worked out. Further, Stern pointed to the need to develop meaningful outcome measures that are functional in nature. We need to look at how these activities are "affecting ... lives" instead of using a "pre-post battery" of lab-based attention tests and goal setting (indications of executive function). He implicates himself in this study limitation and suggests that the shift to healthy aging from disease prevention represents a kind of paradigm shift that researchers are perhaps not quite ready to tackle. He explains later that he is will currently studying cognitive reserve by comparing imaging with activities and behavior to see how different levels of activity moderate pathology, even opening

[36] Adam M. Brickman, Karen L. Siedlecki, and Yaakov Stern, "Cognitive and Brain Reserve," in ed. Colin A. Depp and Dilip V. Jeste, *Successful Cognitive and Emotional Aging* (Washington, DC: American Psychiatric Publishing, Inc., 2010): 157-172.

up the possibility that pathology might not only be compensated for or circumvented but might even be lessened by the activity.

The warrant for Stern's *Epidemiologically Informed Policy Argument* is that compelling epidemiology along with the trials that have been done are enough to issue general recommendations for cognitive health at this point in time. General recommendations are something that have not been offered before and so represent a real message of sorts. Stern implies that the backing for his warrant is that there would be no cost to issuing recommendation of healthy living for brain health: "In general we know it's good."

Stern's backing for his warrant is that we know the ingredients (physical, social, and cognitive engagement) even if we can't recommend specific recipes. It is a message a bit like the USDA's ChooseMyPlate program (ChooseMyPlate.gov) which that about half of one's diet be comprised of fruits and vegetables, without explaining which proportion of which particular fruits or vegetables or without advocating a specific form of preparation.

Stern's discussion of the difficulty of defining healthy cognitive outcomes raises a major research barrier to the promotion of cognitive health. The State-of-the-Science Conference Statement acknowledged this problem in negative form: "Some of the main reasons for the inability to identify successful interventions may include (1) lack of a validated and consistent definition of cognitive decline...."[37] The issue of outcomes took up a large portion of my

[37] Martha L. Daviglus, Carl C. Bell, Wade Berrettini, Phyllis E. Bowen, E. Sander Connolly, Nancy J. Cox, Jacqueline M. Dunbar-Jacob, Evelyn C. Granieri, Gail Hunt, Kathleen McGarry, Dinesh Patel, Arnold L. Potosky, Elaine Sanders-Bush, Donald Silberberg, Mauritzio Trevisan, "National Institutes of Health State-of-the-Science Conference Statement: Preventing

interviews but extends beyond of the scope of the current project. There was near unanimous agreement that outcomes should be functional rather than based on biomarkers alone. In other words, the ability to function in everyday life mattered more than the presence of Alzheimer plaques and tangles in the brain.[38]

Before continuing with argument analysis, I would like to examine two risk factors chosen by the NIH Cognitive and Emotional Health Project report and the HBI as having the best evidence for public health: vascular risk factors and physical activity/inactivity.[39] To me also this evidence appears much stronger than the evidence for cognitive engagement.

Vascular Links to Cognitive Health

It appears that a breakdown in the integrity of discrete disease categories is central to the shift from thinking about Alzheimer's disease cures to thinking about cognitive health promotion in vascular terms. The Diagnostic and Statistical Manual of Mental Disorders, for example, classifies Alzheimer's

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Alzheimer's Disease and Cognitive Decline," *NIH Consensus State of the Science Statements* 27, no. 4 (April 2010): 14.

[38] How did these researchers define a healthy brain? They described it in terms of what it enabled an individual to do and what benefits those functions conferred to society. To Dr. Jennifer Manly it is a brain that can "learn," "be flexible," "produce," and "control your body in the way that it needs to." It is also one that is "thriving" at any age. Healthy elder brains are valuable to society because they yield "stored wisdom and stored knowledge." To Dr. George Rebok a healthy brain keeps us "engaged," "connected," and "functioning" in society, and it builds societal engagement, civic engagement, and social capital among social groups. To Dr. Stern the healthy brain "is able to maintain function." To Dr. Whitehouse it enables "learning," "action," "creativity," and "adaptability." Dr. Whitehouse summed up the general view of the interviewees by saying that a healthy brain is "a brain that acts in the world." The two geriatric psychiatrists offered definitions that included emotional qualities. In defining the healthy brain, Rabins mentioned "cognition," "behavior," and "emotions." Dr. Hugh Hendrie pointed to three integral functions: "cognition," "emotion," and "motivation." Dr. Leonard Poon noted that the "Brain is physiology but cognition is more than physiology – it encompasses physiology and sociology and psychology." He further called cognition "a behavioral output," or function. Many of the researchers emphasized the difference between structure and function as crucial to the understanding of cognitive health.

[39] CDC and AA, *Road Map*, 1.

disease and vascular dementia as separate diseases, the most and second most common causes of dementia, respectively.[40] Under this traditional classification system, Alzheimer's is a neurodegenerative disease, affecting neurons, and vascular dementia is a consequence of heart disease, affecting the blood vessels of the brain. Traditional estimates have described Alzheimer's disease as the most common form of dementia, accounting for about half of all cases.[41] However, there is no consensus on exact numbers and there is some evidence the categorical estimates are in flux. A recent study conducted at the Veteran's Affairs, for example, found that only 30-50% of its veteran population had Alzheimer's disease and that the balance was shifting towards vascular-type dementias.[42]

In 1997 the Nun Study, a longitudinal study of aging and Alzheimer's disease, reported that the presence of vascular infarcts in brains with significant Alzheimer's pathology in autopsy corresponded with poorer cognitive function in life. The researchers concluded that "a few small infarcts in strategic regions of the brain may be sufficient to produce dementia in those made vulnerable by abundant neuropathological lesions of AD in the neocortex. Alternatively, it is possible that our findings have less to do with the location of the infarct and more

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[40] American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders DSM-IV-TR Fourth edition* (text revision) (Washington, D.C.: American Psychiatric Association, 2000).

[41] The Alzheimer's Association claims that AD accounts for 60-80% of cases. See Alzheimer's Association, "2012 Alzheimer's Disease Facts and Figures," *Alzheimer's & Dementia* 8, no. 2. (2012): 131-68.

[42] Elliot D. Ross, Santosh N. Shah, Calin I. Prodan, and Marilee Monnot, "Changing Relative Prevalence of Alzheimer Disease versus Non-Alzheimer Disease Dementias: Have We Underestimated the Looming Dementia Epidemic?" *Dementia and Geriatric Cognitive Disorders* 22, no. 4 (2006):273–277.

to do with the disease process that produce the lacunar infarcts,"[43] i.e., vascular disease. These findings help explain the previously mentioned paradox, also mentioned by these researchers, that the presence of neuropathologic lesions of AD (i.e., amyloid plaques and neurofibrilary tangles) do not necessarily correspond with dementia, that there may be brain or cognitive reserve that protects against functional deficits even with pathology unless that reserve is eroded or overwhelmed by comorbidities. In other words, even if Alzheimer's disease represents a distinct neurodegenerative process, it often co-occurs with vascular disease (47% of the time in this sample), and it often seems to be the presence of the latter that unmasks the functional symptoms of Alzheimer's.

Other researchers have noted the simultaneous presence of vascular factors and Alzheimer's disease, including Alois Alzheimer himself who observed three elements in the brain of the first Alzheimer's case in 1907: senile plaques and neurofibrillary tangles (new elements) as well as arteriosclerotic changes.[44] The arterioslerotic element was dropped by Alzheimer's colleague Gaetano Perusini in his description of Auguste D. as the first case in an article making the case for the new disease category in 1909.[45] The Rotterdam Study is credited with associating atherosclerosis with Alzheimer's disease in a paper in 1997, including showing a particularly strong interaction between the presence of the apolipoprotein-E epsilon 4 allele genotype associated with late-onset Alzheimer's

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[43] David A. Snowdon, Lydia H. Greiner, James A. Mortimer, Kathryn P. Riley, Philip A. Greiner, William R. Markesbery, "Brain Infarction and the Clinical Expression of Alzheimer Disease: The Nun Study," *JAMA* 277, No. 10 (March 1997): 813-817.

[44] See Konrad Maurer, Stephan Volk, and Hector Gerbaldo, "The History of Alois Alzheimer's First Case," in *Concepts of Alzheimer Disease: Biological, Clinical, and Cultural Perspectives*, ed. Peter J. Whitehouse, Konrad Maurer, and Jesse F. Ballenger (Baltimore: The Johns Hopkins University Press, 2000), 5.

[45] Ibid., 25.

and atherosclerosis.[46] One neuropsychologist, Jack C. de la Torre, has gone so far as to call for a paradigm shift to reclassify AD as a vascular disorder.[47] Marcus Richards and Carol Brayne call for AD to be considered a syndrome rather than a disease because of overlapping disease boundaries.[48] Those and similar calls opened the subject to exploration of lifestyle interventions used for vascular health.

In an interview, neurologist Peter Whitehouse summarized the blurring of disease boundaries from his perspective as producing indistinct combinations of Alzheimer's, vascular factors, Lewy bodies, and other physical changes associated with the functional outcome of dementia.[49] If combinations of pathologies are present, we need to ask, what is it that matters most? While there is no clear answer, an argument can be made that in a blend of Alzheimer's disease and vascular dementia, the vascular factors matter most because they have been shown to be modifiable. One public health review enumerated associations between Alzheimer's disease and cardiovascular and cerebrovascular disease,

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[46] Albert Hofman, Alewijn Ott, Monique M.B. Breteler, Michiel L. Bots, Arjen J.C. Slooter, Frans van Harskamp, Cornelia N. van Duijn, Christine Van Broeckhoven, and Diederick E. Grobbee, "Atherosclerosis, Apolipoprotein E, and Prevalence of Dementia and Alzheimer's Disease in the Rotterdam Study," *The Lancet* 349, no. 9046(1997): 151-154.

[47] See Jack de la Torre, "Alzheimer's Disease: How Does It Start?" *Journal of Alzheimer's Disease* 4, no. 6 (2002): 497-512, and Jack de la Torre, "Vascular Basis of Alzheimer's Pathogenesis," *Annals of New York Academy of the Sciences* 977 (2002): 196-215.

[48] Marcus Richards and Carol Brayne, "What Do We Mean by Alzheimer's Disease?" *BMJ* 341(2010): 865-867. If Alzheimer's is a syndrome, we are really talking about the syndrome of geriatric dementia. Such a perspective is represented by Peter Whitehouse, interview by author, telephone, September 19, 2011: "This is dementia. It's hard for people to realize that it's dementia."

[49] "[W]e thought we would be able to completely say that there's such a thing as Alzheimer's, such a thing as vascular dementia, such a thing as frontal lobe dementia, such a thing as Lewy body. Any literature you look at there's a huge overlap between these things. We're more confused, in fact I just got asked to comment for ABC News on another study about the relationship between diabetes and dementia. Well, that's because vascular factors play a role in so-called Alzheimer's and it's just a matter of degree how much Parkinson's, how much frontal, how much Alzheimer's, et cetera, et cetera. So all of these studies, not only is it a continuum but it's also the continuum of pathologies to cross the different disease categories, which we think are discrete but which aren't." Peter Whitehouse, interview by author, telephone, September 19, 2011.

strokes, hypertension, and high cholesterol, as well as diabetes, suggesting that these connections could justify a life course health promotion agenda that would be built around a multifaceted intervention involving modifiable risk factors such as dietary fat intake, obesity, type 2 diabetes, hypertension, and physical exercise.[50] As the disease connections proliferate the dementia picture gets more complex and the idea of cognitive health begins to look less complicated by comparison. [51]

The shift to primary prevention of cognitive decline suggested that public health might fairly easily target health behaviors known to prevent vascular risk factors. Supporting this approach are a number of epidemiological studies looking at the outcomes of dementia or lesser cognitive impairment that have found an association with high blood pressure in midlife, including the Framingham Heart Study,[52] the Honolulu-Asia Heart Study,[53] and an unnamed study from Uppsala, Sweden.[54] At least three randomized controlled trial intervention studies have looked at the effect of lowering hypertension with drug

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[50] Sandra K. Pope, Valorie M. Shue, and Cornelia Beck, "Will a Healthy Lifestyle Help Prevent Alzheimer's Disease?," *Annual Review of Public Health* 24 (2003):111-32.

[51] This may have been what geriatric psychiatrist Hugh Hendrie meant in part when he stated that health promotion "starts with an illness, in this case AD, then gets broader and broader with more and more illnesses involved, precursors are examined, such as MCI, cognitive decline, risk factors – and you regress that to cognitive health. It's a kind of reverse mirror to illness." Hugh Hendrie, interview by author, telephone, September 15, 2011. Dr. Hendrie is included here as a researcher but a passage from the interview will not be quoted because of an unfortunate malfunction of the digital recorder.

[52] Merrill F.Elias, Philip A. Wolf, Ralph B. D'Agostino, Janet Cobb, and Lon R. White, "Untreated Blood Pressure Level Is Inversely Related to Cognitive Functioning: The Framingham Study," *American Journal of Epidemiology* 138, no. 6 (1993): 353-364.

[53] See Lenore J. Launer, Kamal Masaki, Helen Petrovich, Daniel Foley, and Richard Havlik, "The Association between Midlife Blood Pressure Levels and Late-Life Cognitive Function," *JAMA* 274, no. 23 (1995): 1846-51; Esther S.C. Korf, Lon R. White, Philip Scheltens, and Lenore J. Launer, "Midlife Blood Pressure and the Risk of Hippocampal Atrophy: The Honolulu Asia Aging Study," *Hypertension* 44, no. 1 (2004): 29-34.

[54] Lena Kilander, Hakan Nyman, Merika Bober, Lennart Hansson, and Hans Lithell, "Hypertension Is Related to Cognitive Impairment: A 20-Year Follow-up of 999 Men," *Hypertension* 31, no. 3 (1998): 780-786.

treatment to prevent cognitive impairment, with mixed results. But because these trials are extremely short relative to the pathological course of cognitive decline or heart disease, are usually conducted exclusively with people with cardiovascular disease or hypertension, and often start later in life, they do not seem to be suitable evidence for primary prevention despite positive results.[55] It can also be noted that these same limitations apply to two earlier studies not showing an effect of drug treatment on cognition.[56] However, both of these latter studies were intent on noting that there was no harm in lowering blood pressure in people later in life. This finding spoke to concerns that low blood pressure late in life is often associated with cognitive decline. That these studies show inverse relation between blood pressure level and cognitive performance is not sustained late in life is thought to be because of the effects of the neurodegenerative and vascular diseases on blood pressure. This finding further suggests a possible need to intervene before hypertension is established. Therefore, the Framingham Study showing that untreated hypertension in midlife correlates with poor

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[55] For example: 1) Francoise Forette, Marie-Laure Seux, Jan A. Staessen, Lutgarde Thijs, Marija-Ruta Babarskiene, Speranta Babeanu, Alfredo Bossini, Robert Fagard, Blas Gil-Extremera, Tovio Laks, Zhanna Kobalava, Cinzia Sarti, Jaakko Tuomilehto, Hannu Vanhanen, John Webster, Yair Yodfatm, Willem H. Birkenhager, "The Prevention of Dementia with Antihypertension Treatment: New Evidence from the Systolic Hypertension in Europe (Syst-Eur) Study," *Archives of Internal Medicine* 162, no. 18 (2002): 2046-2053; 2) Hans Lithell, Lennart Hansson, Igmar Skoog, Dag Elmfeldt, Albert Hofman, Bertil Olofsson, Peter Trenkwalder, and Alberto Zanchetti, "The Study on Cognition and Prognosis in the Elderly (SCOPE): Principal Results of a Randomized Double-Blind Intervention Trial," *Journal of Hypertension* 21, no. 5 (2003): 875-886; and 3) The PROGRESS Collaborative Group, "Effects of Blood Pressure Lowering with Perindopril and Indapamide Therapy on Dementia and Cognitive Decline in Patients with Cerebrovascular Disease," *Archives of Internal Medicine* 163, no. 9 (May 2003): 1069-1075.

[56] Martin J. Prince, Anne S. Bird, Robert A. Blizard, and Anthony H. Mann, "Is the Cognitive Function of Older Patients Affected by Antihypertensive Treatment? Results from 54 Months of the Medical Research Council's Treatment Trial of Hypertension in Older Adults," *BMJ* 312, no. 7034 (1996):801-805; William B. Applegate, Sara Pressel, Janet Wittes, Judith Luhr, Richard B. Shekelle, Greta H. Camel, Merwyn R. Greenlick, Evan Hadley, Lemuel Moye, H. Mitchell Perry, Jr., Eleanor Schron, and Vicki Wegener, "Impact of the Treatment of Isolated Systolic Hypertension on Behavioral Variables: Results from the Systolic Hypertension in the Elderly Program," *Archives of Internal Medicine* 154, no. 19 (1994):2154-60.

cognitive function later in life seems to be the best evidence for this early intervention.

In addition to being independently associated with cognitive outcomes such as Alzheimer's disease, vascular conditions frequently influence cognitive health directly. The Framingham Study found a significant 3.7-point drop in the mean Mini-Mental State Exam score in stroke patients within 6 months of having a large, left-sided stroke, as compared with no change in controls.[57] Another group found that 35.2% of stroke survivors were cognitively impaired, as opposed to 3.8% of controls, and that of those that were cognitively impaired, 55% were having functional consequences such as the inability to live independently.[58] Aside from recommending the lowering of hypertension to reduce risk of vascular dementia or Alzheimer's disease, one could recommend it to prevent atrial fibrillation, or sluggish blood flow, that can decrease flow of blood to the brain or precipitate the formation of blood clots and stroke. Hypertension has been shown to alter cerebral blood vessel structures, facilitating vascular occlusion and compromising cerebral perfusion.[59] According to the CDC, high blood pressure and heart failure are also risk factors for atrial fibrillation,[60] which diminishes

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[57] C. S. Kase, P. A. Wolf, M. Kelly-Hayes, W. B. Kannel, A. Beiser and R. B. D'Agostino, "Intellectual Decline After Stroke: The Framingham Study," *Stroke* 29, no. 4 (1998):805-812.

[58] T K Tatemichi, D W Desmond, Y Stem, M Paik, M Sano, E Bagiella, "Cognitive Impairment after Stroke: Frequency, Patterns, and Relationship to Functional Abilities," *Journal of Neurology, Neurosurgery, and Psychiatry* 57, no. 2 (1994):202-207.

[59] See Franco Veglio, Cristina Paglieri, Franco Rabbia, Daniela Bisbocci, Mauro Bergui, and Paolo Cerrato, "Hypertension and Cerebrovascular Damage," *Atherosclerosis* 205, no. 2 (2009): 331-341.

[60] See CDC, "Atrial Fibrillation Fact Sheet," Division for Heart Disease and Stroke Prevention website, http://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_atrial_fibrillation.htm (accessed October 21, 2012).

perfusion. Modifiable risk factors for heart failure include smoking, being overweight, a high-fat diet, high cholesterol, a salty diet, and physical inactivity.[61]

A non-drug intervention that has received official sanction to lower hypertension is physical activity. As far back as 1996 the NIH held a Consensus Conference on Physical Activity and Cardiovascular Health and set a guideline of 30 minutes moderate-intensity physical activity on most days of the week for cardiovascular health, including high blood pressure. The statement noted that physical activity has secondary preventive effects (it "modifies" high blood pressure and thereby helps prevent cardiovascular disease) but also primary prevention effects ("Most studies of endurance exercise training of individuals with normal blood pressure and those with hypertension have shown decreases in systolic and diastolic blood pressure.") The statement further attributed improved insulin sensitivity to endurance exercise."[62] The 2004 *U.S. Guide to Clinical preventive services*, Second Edition included a section that recommended that physicians counsel patients to engage in regular physical activity, preferably daily, "to prevent coronary heart disease, hypertension, obesity, and diabetes. This recommendation is based on the proven benefits of regular physical activity...." [63] The report further suggests that physical activity

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[61] See CDC, "Heart Failure Fact Sheet," Division for Heart Disease and Stroke Prevention website, http://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_heart_failure.htm (accessed October 21, 2012).

[62] Russell V. Luepker, Suzanne Bennett Johnson, Lester Breslow, Aram V. Chobanian, Clarence Edward Davis, Brian R. Duling, Shiriki Kumanyika, Ronald M. Lauer, Punkie Lawson, Patrick E. McBride, Suzanne Oparil, Ronald J. Prineas, Reginald L. Washington, "Physical Activity and Cardiovascular Health: NIH Consensus Development Panel on Physical Activity and Cardiovascular Health" *JAMA* 276, no. 3 (1996):241-6. Note that the health promoter Lester Breslow was on the panel for this conference.

[63] U.S. Preventive Services Task Force, "Section 55 Counseling to Promote Physical Activity," in *Guide to Clinical Preventive Services, Second Edition. Report of the U.S. Preventive Services*

can consist of everyday tasks of moderate intensity such as raking leaves, cleaning windows, and light restaurant work for a duration of 60 minutes or everyday tasks of vigorous intensity such as shoveling snow for a duration of about 20 minutes.

Today CDC's Stroke page points visitors to a brochure called "Know the Facts about Stroke," which says that one of the signs and symptoms of stroke is "Sudden confusion or trouble speaking or understanding others" but does not anywhere mention any long-term cognitive effects of stroke that might give the concerned added reason for engaging in preventive behavior. The only apparent consequence of stroke is death rather than years of chronic disability. The focus of the page seems to be on recognizing symptoms in order to get immediate treatment for stroke, but there is also a section "Can it be prevented?" that takes the long view and recommends to "Prevent or treat your other health conditions, especially high blood pressure, high cholesterol, and diabetes." The linked page on HBP states under "What you can do" includes the advice: "How to Prevent HBP: • Eat a healthy diet ... Avoid sodium by limiting amount of salt you add to food."[64] The CDC's Sodium Fact Sheet presents research on how low sodium both lowers blood pressure in both those with high and normal blood pressure, suggesting a long-term social benefit,[65] as blood pressure tends to rise with age. Given this officially sanctioned advice, it seems a small step to recommend

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Task Force, http://odphp.osophs.dhhs.gov/pubs/guidecps/default.htm, (accessed October 10, 2012).

[64] CDC, "Know the Facts about Stroke," Division for Heart Disease and Stroke Prevention website, http://www.cdc.gov/stroke/docs/ConsumerEd_Stroke.pdf (accessed October 5, 2012).

[65] CDC, "Sodium Fact Sheet," http://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_sodium.htm (accessed October 5, 2012).

lowering salt intake and encouraging physical activity to promote cognitive health as well as vascular health.

Control of Hypertension and Physical Activity for Cognitive Health

Two researchers interviewed delved into the vascular-cognitive connection, Peter Rabins of Johns Hopkins University and Peter Whitehouse of Case Western University, using different arguments for public health action. I will quote a passage from each interview, analyzing each in turn, beginning with the words of Dr. Rabins.

Peter Rabins

Dr. Rabins presents the view of a practicing physician who has treated Alzheimer's disease for most of his career and who was asked to serve on the advisory board at the Alzheimer's Association and later on the Healthy Brain Initiative (Prevention Research Workgroup).

> [T]he idea that primary prevention might really be the most effective strategy, in a sense, for wiping out the disease seems like an obvious point for any of us, but it hasn't really been a major focus, I don't think, of people that are studying Alzheimer's disease and dementia and thinking about the treatment, if you will, so I think part of the timing [of the HBI] was that there was sort of frustration with the treatments that were available, and although there was optimism that some of the new directions that were being taken in therapeutics might really make a difference, again I do think people were starting to realize that those therapies might only slow the disease down or might stop it in its tracks but not allow for recovery, so again I think as people thought about the implications of that again it turned people's thoughts toward primary prevention. I do think that was one of the underlying themes.
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> [M]y view is that even though the CDC has been turning in the direction of chronic illness prevention and care for a long time, there's been very little focus or realization that dementia is really a huge public health issue within the chronic disease field. And I

think there was kind of a lack of recognition that the vast majority of people in nursing homes, for example, are there because of dementia, that this is a *huge* expense, if you just look at the economics, that this is a tremendous part of both state and federal budgets, so the public health issue isn't just the fact there are 4 or 5 million people who have these diseases, and 10 million caregivers that are providing informal or formal care (that may not be the right number), but from a health expense point of view it's a huge issue, and I think for whatever reason the public health field has been very slow to appreciate that.

...So that's why I see the interest in brain health as sort of the positive way of thinking about dementia and brain aging....I think there was sort of an underlying hope or assumption that ... if we could figure out how to maintain a healthy brain that that would lead to strategies to prevent the diseases that cause cognitive decline, dementia. As far as I'm concerned there's no evidence that that's true, but I do think that was an assumption and still is an assumption that we made.

...There was an NIH Consensus Conference, whenever it was, a year and a half ago now, that I was not in any way involved in. That took a very hard-nosed scientific literature review approach to the question of whether we can at least prevent dementia... My sense is that that was a very negative. Well, first they didn't find good evidence that anything can be done to at least prevent dementia, that's sort of my bottom line, which I partly agree with, or at least which I do agree with at the level of clear and convincing evidence. I think where they missed the boat, is the idea that, first that there's not a clear recognition in the report of how difficult it is to do primary prevention studies of the prevalent chronic diseases. We can look at preventing single events like strokes and heart attacks or death, those kinds of hard outcomes, but performing studies to demonstrate that you can lower rates of heart failure or diabetes or depression or dementia is a very different magnitude of study. Because you require very large groups of "healthy normal people" because the incident rate of your outcome is relatively low, you have to follow them for long periods of time, and I don't think there's an appreciation in that report that we don't have that evidence for *anything*. I do think there should have been more emphasis on epidemiologic findings, for example, that midlife hypertension is correlated with the development of dementia in late life, and that if you were going to study that it would take 30 or 40 years and I'm not sure that that kind of study can or should ever be done. What, we're not going to treat people with hypertension? Right? I mean, it's not possible. Or if you're interested in exercise, so are you going to tell people they can't exercise? You can't do crossword puzzles? Or you can't be socially engaged? I think, at least what I saw in the report,

> there wasn't a recognition that those kinds of primary prevention studies will be very difficult to do, not just with dementia but with a lot of the common disorders.
>
> So, again, to me personally, the most convincing evidence now is that early and adequate treatment of hypertension and diabetes in midlife, and probably other vascular disease risk factors, is likely to have some primary and maybe secondary preventive effect. I just don't think that was one that was highlighted. And then number 2, that since the effectiveness of those approaches in preventing heart attack, stroke, death and the complications of diabetes, that they are well established, that it's a very low-cost intervention and so, I think, to be totally hard nosed and say, you have to have clear and convincing randomized trials – I think that's the wrong standard.[66]

In this passage Rabins narrates a kind of flip from the cure-based perspective of medicine to the health-maintenance perspective of health promotion. He uses the term "primary prevention" to signify the effort to prevent risk factors from developing. He describes drug limitations and trial failures as the turning point in the narrative, which represents a move away from a pharmaceutically based solution towards an openness to other possibilities for health promotion.

Rabins represents the health promotion argument as a false argument. The claim is that maintaining a healthy brain will prevent disease. The claim is merely an assumption, which may or may not be true, because there is no evidence to back it up. How can it be warranted? Only through wishful thinking and this warrant cannot be backed. One might say that there is no harm to this wishful thinking, but that is arguable because it reduces credibility of the organizations issuing the recommendations.

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[66] Peter Rabins, interview by author, Baltimore, MD, August 11, 2011.

Finally, Dr. Rabins implies that an argument can and should be built around evidence we do have for public health action. Its claim is that *We should control hypertension and diabetes in midlife to protect the brain*. Rabins asserts that "the most convincing evidence" for prevention is epidemiological data that treatment of hypertension and diabetes in midlife lowers incidence of dementia in late life. This evidence only works with the warrant that epidemiological data can be used in lieu of RCTs, a very different warrant than the one used by the State-of-the-Science Conference. Indeed he insists that the kind of RCTs that we would need cannot ethically be done. It is a warrant backed by the particular context of the times, which Rabins depicts as a sort of public health crisis. Dementia is a huge public health issue within the chronic disease field. Most people in nursing homes have dementia. Rabins alludes to the public Medicaid expense of paying for institutionalizations (Medicare doesn't cover long term care so it reverts to public assistance, a joint federal and state program). Yet he notes that patients are not the only ones afflicted, caregivers too are involved in the suffering, sacrifice, and financial expense of this issue. The warrant is backed by a moral imperative to do something amid the suffering.

In short, the stakes are too high to use the highest standard of evidence. Rabins turns the table a bit to suggest an inability for medicine to cope, the slowness of public health to get involved, and the abdication of responsibility on the part of the State-of-the-Science Statement because of its epistemological stance because he agrees that the RCT evidence is not available for preventive interventions. Imagining attempting to conform to the Panel's requirements of multiple large RCTs confirming results on this complex topic, he notes that no

chronic disease research has been able to meet these demands to date. He alludes to the prohibitive costs of the required research because of the huge numbers of participants needed. More importantly, however, the needed studies would not be ethical. RCTs require a control group that does not engage in the intervention being studied, and prohibiting people from engaging in potentially healthful behaviors for 30-40 years would be absurd. In the absence of the ability to fund or do the kind of research they are asking for, the Panel should at the very least have noted the very low cost intervention that has been shown to avert cardiovascular disease and add a cognitive health message onto it. In my view, Dr. Rabins is a strong proponent of *Epidemiologically Informed Policy Argument.*[67] However, his policy seems to apply at the level of secondary rather than primary prevention.

Peter Whitehouse

Dr. Peter Whitehouse seems to argue for a similar claim while using a different warrant. Below is a passage on cardiovascular risk factors and dementia pulled from my interview with him:

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[67] Hendrie also was troubled by but also ambivalent about the strict reliance on RCTs at the State-of-the-Science Conference: In an interview on September 15, 2011, he stated that "There was a problem in that they [NIH] weren't content with longitudinal/observational studies – the evidence wasn't conclusive unless you could turn it into randomized clinical trials. That was the message. Mostly they were right. But some of the clinical trials would have to start at age 40-50 and be conducted for 30 years. The Women's Health Study did that, so there is precedent." See also Marcelle Morrison-Bogorad, Vicky Cahan, and Molly V. Wagster "Brain Health Interventions: The Need for Further Research," *Alzheimer's & Dementia* 3, no S2 (2007):S80-S85, two participants in the HBI from the National Institute on Aging and a colleague referred to the Women's Health Study as an RCT that demonstrated how animal findings can mislead researchers in their application to humans: "Animal studies do not prove the same changes take place in the human brain with a particular level of exercise, and the human observational studies cannot definitely separate the effects of an active lifestyle on maintenance of cognitive health from other healthy behaviors. Such limitations have become startlingly clear with recent reports from clinical trials of menopausal hormonal therapy, in which findings from animal and observational studies were not borne out for particular groups of woman."

...[T]he Alzheimer's model is failing. We've had years and years of promises about drugs to fix Alzheimer's. And now people are starting to realize that perhaps the pharmaceutical model will not work, and if you do take a broader look at Alzheimer's, as we tried to do in *The Myth of Alzheimer's* and say this [Alzheimer's disease] is not one thing, it is related to aging, more and more epidemiological research suggests that you can prevent Alzheimer's, i.e., improve brain health, by lifestyle issues....[T]he brain is very salient, that's why it's a good point of leverage, and it's very salient in part because as the baby boomers age they're well aware of their own mental changes and they also have the fear of Alzheimer's....

...[T]he consensus panel on preventing Alzheimer's and cognitive decline ... concluded that the evidence was *not* conclusive enough to warrant recommending people change their behavior. I think that was a very unhelpful conference because I think you've got to rethink the epistemology of how you take action in the world....We have created this sense, and this panel reflected it, that you've got to have randomized controlled studies to demonstrate the value of everything. And I sometimes refer to randomized controlled studies as the gold standard because only people who have gold can afford to do the studies. And that's really true. The pharmaceutical industry can afford the tens of millions of dollars to do relatively simple interventions on taking one of two pills, you know, a placebo or not a placebo. If you start talking about doing research on an intervention like our Intergenerational School, it becomes enormously more complicated to do, enormously more interesting ethically wise, enormously more problematic in terms of interpretation of results. So you almost set up a system where pills are the only answer because they're the only ones you can do randomized controlled studies on.... What I'm saying is, when I said they need a broader epistemology, is they need[ed] to consider different evidence.

...They say that 80% of medical practice doesn't have an evidence base, if you're considering it as randomized controlled studies. Particularly in aging, it's practically impossible because in a randomized controlled study you have people in the study who only meet certain criteria, like they're very healthy, they're NIH super volunteers. So when you get to being concerned about generalizability, for example, and generalizing into a patient population that wasn't in the study, most older people can't because they have multiple co-factors – I mean, randomized controlled studies are in some sense very limited in the sense that they really, epistemologically if you think about it, only pertain to the people who are in the study. I mean it's even difficult to generalize outside from people in the study. So I think we have to consider epidemiological information, and they should have

considered that more, I think they have to be a little less FDA-like in evaluating studies, I think they have to consider even narrative. Now narrative is to me very powerful, the stories that people tell about their health. I realize that anecdotes are one-person stories, but if you take a bunch of stories and put them together you can analyze stories as a kind of collective narrative and that becomes a more powerful body of evidence. So I'm just saying we have to be smarter about what we constitute as evidence. As far as I know, they did a very comprehensive review of the literature, I wouldn't fault them on that.

... Physicians are very biased by, like, the last case that they saw. Randomized controlled studies are biased by whoever is going to be recruited into randomized controlled studies, which is a pretty weird bunch of people, frankly (no offense to them). And epidemiologists can be biased based on what sample they have in their study. So, in many ways, the best study you could generalize from is a randomized, stratified sample of the entire human race, if you want to generalize to all of mankind. That's not possible. But you still have to be aware of your recruitment biases, you know, regardless of what you – the limitations of the study are important.

...It would be very interesting to know, if they [another NIH state-of-the-science panel] picked a randomized controlled trial, you know, do the same thing, for cardiovascular health, whether it would come out the same way. Probably there's more evidence, you know, for things like exercise and other things, but given that if you improve heart health you improve brain health, and people that have heart attacks and congestive heart failure clearly have problems with issues having to do with cognition, if you considered cognitive decline and you considered ok we want to prevent people who have heart attacks and who have brain damage or people who have congestive heart failure you could probably have found enough evidence for that and then said with regards to cognitive decline, it would be worth a public health campaign.... This may be a case where you don't need evidence. Since the heart pumps blood to the brain, if you don't have a heart that's working well, you will have a brain that doesn't work well. That could be in two situations that I imagine. One is if the heart stops and you have toxic brain damage on a temporary basis. The other is if you have congestive heart failure and periodically your brain stops being perfused adequately....[interruption]

...if you google the "myth of Alzheimer's," it comes up as the myth is that, you know, that memory loss is inevitable with aging. Well, it is, to one degree or another, and you can never do the experiment of if we all live long enough, would everybody get it? But basically the frequency of incidence of dementia even, let alone mild memory problems, goes up increasingly with age. So I

> think this was part of the fantasy world that if we cured Alzheimer's disease somehow we'd all live with perfect memories. Nobody ever asked the question, Ok, if we find the cure to Alzheimer's disease, what is brain aging going to look like with Alzheimer's cured? Are we going to age with the rest of our bodies aging and our memories not? It's so actually logically inconsistent it's hard to know why people have managed to make this argument successfully. But yes, I believe that basically Alzheimer's is one of several forms of severe cognitive decline, people whose brains unfortunately have aged faster than the rest of them. I'm of that ilk.[68]

Similar to Rabins, Whitehouse first exposes a false argument. He critiques the State-of-the-Science Conference for claiming that *People should not at this point change their behavior for cognitive health*. The evidence given is that no evidence is conclusive enough to prove that changing behavior prevents AD or cognitive decline. The warrant is a conventional and widely accepted one in the science world, that we need RCTs to be conclusive. The backing for this standard, the warrant, is that it is the pharmaceutical standard that we have agreed on for treatment recommendations.[69]

Like Rabins, Whitehouse has no fault with the evidence for the Panel's claim, as he praises the Conference for a fine review of the literature. Instead he challenges the warrant that RCTs constitute the only form of evidence on which policy (i.e., action) can be built. Changing the warrant would change the evidence and lead to a different conclusion. Whitehouse objects to the warrant on several counts. He challenges the integrity of RCT evidence as it applies to the aging population. He sees conflict between the demands of the standard (that subjects

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[68] Peter Whitehouse, interview by author, telephone, September 19, 2011.

[69] In support of this backing, l will re-quote Yaakov Stern, interview by author, New York, NY, October 10, 2011, about the lifestyle modifications examined by the State-of-the-Science Conference: "I think in the end you need randomized trials. You know, you wouldn't accept any medication without them. That's sort of what we're talking about here."

be free of any problems except for the issue under examination) and the population the intervention is intended to reach. Since the vast majority of elders have comorbid conditions, the insistence that the study pool be free of conditions creates a pool of "NIH super volunteers" that represent no one.[70] In fact, Whitehouse implies that RCTs do not even meet their own standards of generalizability because that would have to involve "a randomized, stratified sample of the entire human race," which is absurd.

Second, Whitehouse raises the possibility of a double standard, asking whether cognition is treated differently from cardiovascular health. It is interesting that an objective for the NIH's 1996 Conference on Physical Activity and Cardiovascular Health was to provide physicians and the general public "with a responsible assessment of the relationship between physical activity and cardiovascular health." The goal was not stated as definitive proof. In addition the statement summarizes the evidence in ways that suggest a majority judgment, as when it says "Most [not *all*] studies of endurance exercise training of individuals with normal blood pressure and those with hypertension have shown decreases with systolic and diastolic blood pressure."[71]

Third, Whitehouse argues that other kinds of evidence should not be ruled out because they are more complex than the drug model. Other promising interventions cannot be realistically measured with clinical trials. He mentions

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[70] Hugh Hendrie, interview by author, telephone, September 15, 2011, described two forms of clinical trials. The first is what we usually talk about, testing an intervention on a select group of people. The second is an effectiveness trial that translates the trial into a clinic-based population, and "these are seldom done." Effectiveness trials take 10-20 years and uncover a wide set of side effects on many different kinds of people but confirm that they are not enough to avoid prescribing the drug to most patients. We might add here that in public health the translation would occur at a community-based level, and it is with this diverse patient pool that "you get all the side effects." Clinicians "need to be able to prescribe to any patient."

[71] Luepker et al., "Physical Activity and Cardiovascular Health."

his Intergenerational School, an intervention that combines cognitive engagement, social interaction, community engagement, and presumably physical activity for the cognitive health of older adults. Alternative kinds of evidence he would include are epidemiology and narrative.

After critiquing the State-of-the-Science Conference Statement claim that there are no recommendations for the public for cognitive health, Whitehouse offers a similar claim to Dr. Rabins's but in more general form. His implicit claim is, *We should recommend heart healthy behaviors to protect the brain*. The evidence for this claim is that an ineffective heart pumping action directly affects cognition. Whitehouse provides two examples of ineffective heart pumping. In the first case ("if the heart stops and you have toxic brain damage on a temporary basis") he seems to be referring to an arrhythmia (as in atrial fibrillation), which is damaging on its own but can be the major precipitating factor for stroke, which invariably results in brain damage. In the second case ("if you have congestive heart failure and periodically your brain stops being perfused adequately"), the heart muscle would be enlarged and weakened. Because of this direct effect, behaviors that promote blood perfusion or prevent heart stoppages would protect the brain, as backed by the examples of stroke, heart arrhythmia, and heart failure. Although Whitehouse does endorse the use of a combination of evidence to make responsible recommendations, thereby recommending triangulation across the evidence (a *Triangulated Evidence Policy Argument*), I think most forcefully he argues for a warrant of common sense ("This may be a case where you don't need evidence") because of the direct physiological effects of

heart pumping action on oxygen to the brain. He therefore offers an example of the *Logically Derived Policy Argument*.

Like Rabins, Whitehouse further supports his argument that vascular evidence can be used as cognitive health evidence with the suggestion that we are in a kind of public health crisis. As Whitehouse sees all forms of dementia as connected to aging, he expects rates to increase at the same time that other planetary crises require the collective wisdom of intact elder brains. Later in the same interview he states that:

> the fact that if individual members had healthier brains then the collective wisdom (a word I use not infrequently) of the community would be better. And that I use to say that that's a very important issue, because our civilization is totally threatened and our species is threatened because we are *not* operating with enough collective wisdom to address social and environmental challenges. So it means a *lot* to the community to have individual and collective healthy brains.

To Whitehouse cognitive health is a population-level issue because of large-scale global issues that require a combination of age-related experience (wisdom) and brain power to solve.

Dr. Whitehouse offers an example of the *Logically Derived Policy Argument* by suggesting that vascular evidence can in a sense be co-opted in the service of cognitive health promotion. Although his claim is similar to that of Dr. Rabin's the two use evidence differently. Dr. Rabins would widen allowable evidence to include longitudinal studies, whereas Dr. Whitehouse would logically graft vascular evidence to cognitive outcomes. The gist of his argument is that we can promote heart healthy behavior for cognitive health because heart health directly affects brain health.

An Argument for Physical Exercise

In addition to the endorsements for physical activity as a way to maintain healthy cognitive function based on a logical derivation of the evidence, many researchers have worked on showing the connection directly. Dr. Art Kramer of the University of Illinois at Urbana-Champaign was one of the earliest and most steadfast researchers on the subject. Dr. Kramer's lab at the Beckman Institute for Advanced Science and Technology has been studying the effect of exercise on cognitive functioning in healthy older adults for some time. In a study published in 1999,[72] the group found that a six-week intervention randomly assigned to adults age 60-75 years old who reported having sedentary lifestyles to either walking (aerobic) or stretching and toning (anaerobic) intervention groups. The walking group showed a significant improvement first in the maximum rate of oxygen consumption compared with the control group (an increase of 5.1% compared with a decline of 2.8% in the control group). It then found improvements in three exercises that have been associated with executive control processes involving attention such as working memory, inhibiting distractions, and everyday tasks such as scheduling. Following the intervention, reaction times decreased significantly for only the exercise group on a test involving switching between tasks and on a test with distracter interference. These results are impressive because they represent a transfer of the training effect from the domain of physical exercise to cognitive function, specifically executive function

[72] See Arthur F. Kramer, Sowon Han, Neal J. Cohen, Marie T. Banich, Edward McAuley, Catherine R. Harrison, Julie Chason, Eli Hakil, Lynn Bardell, Richard A. Boileau, and Angela Colcombe, "Ageing, fitness and neurocognitive function," *Nature* 400, no. 6743 (1999): 418-49.

tasks that involve planning and attention. However, the study had only 127 subjects, previously sedentary adults age 60-75 years old. In addition, lab-based tests of executive function are not necessarily everyday tasks or signs of health out in the community.

In more recent publications Kramer and colleagues recommend aerobic fitness training for brain health but admit that "at present we know little about how to design exercise interventions that optimize the effects on cognition and brain health."[73] The authors recommend further research to determine the type, dose, frequency of exercise activities and when in life it is best to begin. They also point out that they do not know how exercise is able to boost cognitive functioning in both children and adults when the two groups are at such different stages of brain development. However, the *black box paradigm*, which allows for an exposure-outcome conclusion without understanding of the mechanism, has been an acceptable part of public health since the later 20th century.[74] From a practical perspective, it may be more important to know that something is effective than to know how the mechanism works.

Jennifer Manly

Neuropsychologist Jennifer Manly of Columbia University banked on Kramer's model of research to endorse physical exercise for brain health. She did not specify that its benefit was due to vascular factors but mentioned a range of possibilities. An excerpt from her interview follows:

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[73] See Charles H. Hillman, Kirk I. Erickson and Arthur F. Kramer, "Be Smart, Exercise Your Heart: Exercise Effects on Brain and Cognition," *Nature* 9 , no. 1 (2008): 63.

[74] See Mervyn Susser and Ezra Susser, "Choosing a Future for Epidemiology: I. Eras and Paradigms," *American Journal of Public Health* 86, no. 5(1996): 668-673.

[T]here are some things that clearly, I think, are promising. You know, aerobic exercise is one of those things. I think that we have some darn good evidence in randomized trial studies that exercise can help a whole myriad of things, and it's not exactly clear the mechanism, I think, but it can maintain healthy cognitive function. It may be through mood, which is another thing that it seems to have an affect on, but it may actually be through increased, healthier vasculature of the brain, it may be through new cell generation, you know, who knows what the mechanism is. People are working hard on that. But I do think that's probably the only thing I've seen out there, the only intervention that's been properly tested [with randomized controlled trials] that seems to make a difference.

The issue there is that you want to be able to tell people that this makes a difference over and above whatever other things drove people to exercise in the first place. So what we have, ok, let's say we find out blueberries. Ok, we have an observational study, we ask everyone exactly what they eat all the time every day and then we find through our statistical analyses that the people who eat more blueberries have healthier, better cognition. They could have better cognition at that time point when they're eating blueberries, they could also have better cognition later on when we visit them five years later, they could maintain their cognitive function while everybody else is going down. So then I write a study, blueberries are healthy for the brain. The problem is it's possible that a whole different kind of person eats blueberries. Like who would eat blueberries? You go to the store, they're super expensive, when they're not in season they taste funky, maybe they're all from California, these people, who knows, I'm just making up stuff. Different kinds of people eat blueberries. Maybe some other factor – maybe these people are better off. Blueberries are $5.99 a packet. Yeah, they're tasty but you can only afford them if you have money to spend. And that money could also go to access to healthcare, it could also go to a gym membership.

...What I'm saying is that there's a lot of messiness in what we measure. And so the best way to do it is a randomized trial, where you take a whole bunch of people, they are the same essentially on average to begin with, and you put one group randomly (roll the dice or flip a coin) and you put one group into the treatment trial and you put another group into a trial where they're getting everything that the other folks are getting except for the actual thing. So in drug trials they do it with a placebo, in exercise trials they get them together socially because that's what generally happens with exercise, you do it in a gym or you do it on a treadmill or something, but they do something that's not aerobic, so they'll do stretching or like yoga or something. So the

difference between those two groups, theoretically, the only thing, is that they're getting the aerobic. It's hard to do in a lifestyle intervention, though.

[On evidence right now to promote behavior change:] What I think we have, as I said, we have exercise. We have one thing that I would put everything behind.... What I would say is, of course, consult with your doctor, because not everyone should go out and do aerobic exercise, but I *would* say to people who are in their thirties, forties, fifties, that, you know, exercise is very important to keep your whole body healthy including your brain, and to figure out a way to get that done for yourself now is going to help you later in life to continue to do it better in life. Form a routine that makes you feel good. Because it does feel good. It makes you feel good and that you'll want to continue. Maybe you, like I did, you know, last year, maybe you hurt your knee and you need to go do something different for a little while, but the whole idea of getting aerobic exercise is still with you, you don't lose that. Really we should be doing that. We are, but we really should be pushing with kids, because that, I think, is where it starts. And then teaching people to maintain that as their body changes over time, you know, is really important. I was at this thing in Detroit. They have a Minority Resource Center for Aging Research out there, and they focus on African Americans....It's in Detroit, it's a partnership between two guys are the PIs, James Jackson who's at the University of Michigan and Peter Lichtenberg who's at Wayne State University. And they did this great thing. There's an African American museum, history museum, there in Detroit, and they invited the community there, and they had this guy who's doing chair exercises, so everyone was sitting down and he was up on the stage and his helpers, you know, it's like an aerobics video but it's all from the chair, so people who feel that they have limited mobility, like I can't get up, I can't move, I can't exercise because my legs aren't working, he was showing them how to do heart rate exercises from the chair that were safe and healthy, and I thought it was great. We need to teach people ways of maintaining their active, doing whatever it takes, whatever this effect is, maintaining this effect in many different ways that accommodate the aging body. So I think that would be, just focused in and of itself, would be fantastic....

...One thing I sort of said under my breath just now is that the ACTIVE trial wasn't really, that I hadn't seen evidence from the ACTIVE Trial that would make me think that there is, that that approach is one that has hope in preventing cognitive decline or in preventing Alzheimer's disease. Or in promoting or maintaining health, that that specific approach. Because the evidence is just not there. The evidence, based on the ACTIVE Trial, I think, was that there was *no* real improvement, and "real"

> being defined as a group of people on the basis of their experience in the trial are significantly better off cognitively than they would be had they never taken part in a trial. Had they never taken part in those exercises. I actually think that, I could be wrong. Most neuropsychologists do think that those kinds of cognitive activities could have the potential of maintaining healthy brain function, and I'm just waiting for there to be convincing evidence of that.[75]

Manly's claim is that *We can recommend aerobic exercise to promote cognitive health*. She makes it clear that whether it is through heart health, psychological health, or neurogenesis, exercise has been shown to "make a difference." She tempers the message by saying that people should consult with their physicians if they have health conditions before undergoing an exercise routine. She even gives the health promotional message that one should note how good it feels in order to motivate oneself to continue to establish the habit so that it will be sustainable. The habit of exercise works in different ways at different times of life, she implies, and it is good to establish the routine as early in life as possible. One established it can be adapted to the changing body even to the point of getting aerobic exercise through upper torso movements if one can no longer walk.

Manly states that the evidence for her claim are RCTs conducted by Art Kramer's lab. Those studies randomize people so that they are presumably unaware of their intervention condition (aerobic vs. toning) and then measure pre- and post- change on measures of cognition. In contrast, she gives an example of an RCT that does not seem to make a difference. According to Manly,

[75] Jennifer Manly, interview by author, New York, NY, October 11, 2011.

the effect sizes are not large enough or meaningful enough to warrant a recommendation.

The warrant that Kramer's work proves that we should be exercising for brain health is that they are RCTs that represent the highest standard of evidence. Manly backs the warrant with a thorough explanation of why RCTS sort out the behaviors that do or do not "make a difference." Her hypothetical example displays the weakness of observational studies, the mainstay of epidemiology. Even if a correlation is found between eating blueberries and high cognition at a later point in life, one does not know if it is the blueberries or another factor that contributed to the difference. However, epidemiologists do typically "control" for various factors such as income to try and isolate the behavioral variables that are significant.

Thus, Manly makes an *Evidence-Based Policy Argument* that physical activity can be promoted for cognitive health. In this she stands apart from the verdict of the State-of-the-Science Conference statement which, in fact, fell short of endorsing exercise as a behavior, while at the same time endorsing the statement as "very accurate."

A focus on the arguments in favor of cognitive health messages has revealed examples of the *Evidence-based Policy Argument* (Leonard Poon, Jennifer Manly), the *Epidemiologically Informed Policy* Argument (Peter Rabins, Yaakov Stern), the *Logically Derived Policy Argument* (Peter Whitehouse) and the *Triangulated Evidence Policy Argument* (George Rebok). All of the researchers with the exception of Poon suggested that public health messages could be issued to promote cognitive health on one or another dimension. The messages ranged

from the very general (Stern's *Exercise, remain active, be socially engaged*) to the more specific (Rabin's *Control hypertension and diabetes in midlife*). The researchers differed greatly in the degree to which they were willing to cross out of their disciplines into a public health policy realm. Poon did not go there, and he and Manly adhered to the strict standard of RCTs. The other researchers justified their use of additional forms of evidence with warrants that noted the limitations of RCTs and were backed by a moral imperative of public health urgency amid population aging that called for a different set of standards.

From my viewpoint, the *Logically Derived Policy Argument* makes the most sense because it uses proven interventions and existing public health messages to address a secondary outcome of cognitive health. Rather than waiting to redo trials for cognitive health, which may never be feasible, existing trials can be interpreted in the service of cognitive health. Interventions that are familiar to the public but are underused (i.e., physical activity) are promoted with an additional benefit. The risk of issuing a wrong message in this case is a healthier population.

Chapter 3: The cognitive health marketplace

Claims that products and practices can improve cognitive performance are nothing new in the United States. Before Coca-Cola was "delicious and refreshing" it was an "ideal brain tonic," containing both cocaine and caffeine (See Figure 3.1).[1] Effortful techniques for improving cognitive performance for one's profession extend back in history as far as the sixth century BCE.[2] Today we have our own stimulants – including amphetamines, modafinil, and energy drinks – to stay "sharp" through the day. Technology has largely replaced the need to mentally store knowledge for spontaneous performance. The focus today is on claims that brain products do not just prepare people for situations involving cognitive performance but also generate improvements in long-term cognitive health, and that these claims are empirically based. Marketers of

[1] Coca-Cola was advertised as a brain stimulant in the late 1880s and beyond when it contained cocaine. See, for example, Mark Pendergrast, *For God, Country and Coca-Cola* (New York: Collier Books, 1993).

[2] The memory arts were used professionally by Roman orators, politicians, and adjudicators; by medieval Dominican and Franciscan preachers; by eastern Europeans who memorized formulas and themes to perform poetic songs spontaneously. An ancient architectural memory art was co-opted into modern psychology as the "method of loci," where it became reduced to a "mnemonic trick" for older adults to remember grocery lists (something they could easily write down). For a discussion of the change in uses of these arts see Anna Vandenberg, "Communication, Ethics, Learning: The Lost Contexts of Memory Arts," (master's thesis, York University, 2005).

cognitive health products argue that consumers who care about their brains should change their behavior by using these products or services to maintain or promote their own cognitive health. This chapter will examine the claims made by marketplace participants, three from the cognitive fitness industry and one from the general brain health wellness segment. All of the cognitive fitness industry representatives use *Evidence-Based Policy Arguments* based on similar evidence. The general brain health and wellness representative offered the most convincing of the four arguments, which as in Chapter 2 was a *Logically Derived Policy Argument*.

Fig. 3.1. April 15, 1894, ad for the Douglas, Thomas & Davison soda fountain in Atlanta, GA.

Older adults appear to be fueling new markets to improve and maintain cognitive health. A retail concept called Marbles that features games "designed to stimulate and strengthen the brain" was launched with the headline "Outsmart

your age! Visit Marbles: The Brain Store," and it has burgeoned into a 25-unit chain of retail establishments in three years. (See Figure 3.2)[3]

Removed because of copyright restriction
(see http://www.shopwoodfield.com/directory/marbles_the_brain_store)

Fig. 3.2 Marbles The Brain Store storefront, Schaumburg, IL.

The marketplace for cognitive health includes brain health supplements, stress reduction techniques, and brain wellness coaching. One of the most visible cognitive health businesses is the brain fitness software industry, which grew 35% in one year, from 2008 to 2009, to reach $295 million in revenues in 2009.[4] The

[3] "OUTSMART YOUR AGE! Visit Marbles: The Brain Store," October 1, 2008, press release announcing Marbles grand opening, http://www.marblesthebrainstore.com/files/grandopening_100108.pdf (accessed May 24, 2012).

[4] According to SharpBrains annual market research report, the brain fitness software industry alone grew million in revenues. See *Transforming Brain Health with Digital Tools to Assess, Enhance and Treat Cognition across the Lifespan: The State of the Brain Fitness Market* (San Francisco: SharpBrains, 2010).

marketing for these products appears to speak to aging populations who are concerned with working memory[5] as much as knowledge memory. None of the people I interviewed seemed to have a particular interest in older populations but revealed that by default they are serving the generation of aging baby boomers. There is clearly a perceived need that is being met through these products and services, which are viewed by researchers and policymakers outside the industry as anywhere from snake oil products to legitimate methods of cognitive maintenance and improvement. Most of the interviewees hinted that there was a moral imperative for sooner rather than later public health action. If a dementia epidemic is forecasted as inevitable, the status quo of not issuing a public health message endorsing behaviors is presented as a very expensive option.

I will start the analysis of cognitive health industry discourse with the man who has the broadest viewpoint of the brain fitness market: Alvaro Fernandez, the CEO of the market research firm SharpBrains, which started at about the same time as the HBI, in 2006. SharpBrains tracks the cognitive and brain fitness market, which sells computer products that purport to assess and enhance cognitive functions. Its *Guide to Brain Fitness* features interviews by scientists, product reviews, and practical advice "to keep your brain sharp."[6] In the passage that follows Fernandez uses similar evidence to argue that *cognitive training can be recommended to maintain and improve cognitive function*, the type of message that consumers desire.

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[5] For a review of this concept of limited capacity memory that serves in-the-moment needs, see Alan Baddeley, "Working Memory: Looking back and Looking forward," *Nature reviews, Neuroscience* 4, no. 10 (2003):829 -839.

[6] Alvaro Fernandez and Dr. Elkhonon Goldberg, *The SharpBrains Guide to Brain Fitness* (San Francisco: SharpBrains: 2009).

Alvaro Fernandez

So if we have people living 80, 90, 100 years, and obviously given the fact that age itself is a risk factor for Alzheimer's and cognitive impairment, this is obviously a public health issue. Because the more you can compress morbidity at the end that's going to have a huge impact on the individual but also on society perspective in terms of well being and in terms of producing. So our perception also is that there's been huge progress worldwide in cardiovascular health in the last 40-50 years, there's been a whole fitness revolution, people now understand the value of nutrition and exercise, maybe everyone doesn't practice it but at least everyone understands the basics, and maybe 30-40% of people are pretty good at doing it. We think the frontier of health now, of public health, is precisely cognitive brain health, which contains cognitive and emotional health, for those two reasons. One, to prolong the health of that aging population and second, the other side of the coin, is to compress the morbidity of Alzheimer's disease, which is going to be one of the main risks to wellbeing of all of us.

[The State-of-the-Science Conference Statement] was fascinating. And it has been controversial because some people have been saying, well, it's very negative because basically it says that nothing works. But I think, first of all, it was a very healthy that someone was independent and took all the different interventions using exactly the same rulers and there are some surprises. If you go deeper into the evidence review, in fact the factors that were most protective were cognitive engagement and physical exercise. But from the cognitive engagement options the single factor with more evidence that was protective was cognitive training, and that has been completely ignored by the media and by most people and, of course, there's all this debate about cognitive training, does it transfer, doesn't it, but from that perspective it was clearly identified as a protective factor.

So I think the problem is that we have to identify what is the outcome. So many times from the public health perspective the priority, my suggestion, if I had in front of me the key person in the US in terms of public health, maybe is exactly what you started with, is how do we define the healthy brain? How do we measure the healthy brain? Because I think the starting point of the NIH review was about preventing Alzheimer's or preventing cognitive decline. Those were the two outcomes that they care about and, of course, those are important, but they didn't pay attention to, I think, another very important public health objective, which is maintaining cognitive functionality. Even if it's only five years, or ten years, well, that's a huge objective and there is more evidence of what can accomplish that, but that was not

done, that was obviously not explained to the media, so there was a sense of doom that makes absolutely no sense. It's very different to a person, to tell that person, hey, there's nothing you can do so that for sure this is a guarantee you won't have Alzheimer's disease thirty years from now, and that is true, but that is not what – we do a lot of consumer surveys, as well, with focus groups so we understand what people themselves are thinking, so we're not only close to policymakers and thinking all these people are stupid, no we really understand extremely well what actually people are thinking and feeling about this topic, and what they really care about is how to protect performance. Even if you get just two more years. So that's a very important objective that was completely ignored in the NIH report.

One [reason for the lack of interest was] because of all the controversy about brain training. And another factor in all these conversations is the success of the Nintendo game "Brain Age" that, on one hand, was good because it created interest in people to exercise their brains in new ways, but also it trivialized the conversation and then somehow it motivated some scientists who are not very close to the literature of cognitive training to basically disregard the whole category, to say hey, the whole thing is a joke, it's just Nintendo-like games. They have no idea of what is truly going on but they feel entitled to make huge categorical statements.... in a sense cognitive training by association with Nintendo maybe has got not a very good reputation. But then the other factor is that it's a completely new instrument or category and, like any new category, it's not very clear how to use it, what is the value, and also what are the limitations.

What is pretty fascinating is ACTIVE. Ok, so what did it find? It found something amazing, which is five years after an initial cognitive 10-hour intervention, something was measurable. And there's a bit of a debate, well, it didn't transfer to everything, but that something was measurable five years afterwards, that itself is very meaningful. And then the implication, from my perspective and from the point of view of many consumers and many other agencies is well, maybe it doesn't transfer so we just need to train a bit of everything, so we help people maintain those targeted abilities. So it's not a magic pill, you want that it's not enough ... But from the medical model they think it's the opposite, it's well, because it doesn't solve all problems, then we couldn't care less, it doesn't work.[7]

[7] Alvaro Fernandez, interview by author by Skype, September 13, 2011.

Fernandez's passage reflects an *Evidence-Based Policy Argument* mainly based on evidence from the ACTIVE Trial. According to Fernandez, the State-of-the-Science Conference constructed an Evidence-Based Policy Argument that behavior change could not be recommended for preventing Alzheimer's disease and cognitive decline (recalling the title of the conference). He accepts this reading of the evidence. Fernandez makes it clear that he thinks the same evidence and methods can argue for the recommendation for cognitive fitness to maintain or improve cognitive health. "Maintaining cognitive functionality" is a separate goal from preventing disease, a "very important public health objective" that was not addressed by the Conference.[8] If this endpoint had been considered, the ACTIVE Trial would have been adequate evidence to show the long-term effects of enhancement on trial participants and these effects alone support the claim that cognitive exercise promotes cognition. Fernandez suggests that he agreed with the 2006 finding that there were transfer effects from the reasoning training on everyday functioning ("well, it didn't transfer to everything...") but indicates that transfer is not necessary to show meaningful effect ("maybe it doesn't transfer, so we just need to train a bit of everything, so we help people maintain those targeted abilities"). The warrant in this argument must be that neurological tests (lab-conducted tests of particular cognitive skills) are evidence enough of cognitive functioning. The backing is not stated but perhaps we can imagine the analogy that school tests have been conventionally and implicitly

[8] Fernandez does not acknowledge the presence of a separate question on cognitive health; he did not perceive it to alter the focus of the Conference on preventing disease.

considered to be indicators of ability to function in the world outside of the classroom for many decades.

Fernandez seems to contradict himself slightly. It is very clear he is interested in cognitive functioning. That is, he indicates that SharpBrains and consumers both care about is functioning even in the presence of disease. All that really matters is to delay manifestation of the disease or compress morbidity, reminding us of Timothy Salthouse's alternative scenario discussed in the last chapter in which enhanced performance would slow the decline to a threshold of dysfunction. In fact, compressing morbidity for five years (which is the length of the effect of the ACTIVE Trial training interventions as measured to date) would indeed have "huge impact on the individual but also on society." Later in the interview he indicates that functionality and medical status diverge:

> if you adopt the medical model, especially the confusion with Alzheimer's is that the medical community seems obsessed with biomarkers and then seems to assume that just the presence of a quality equals the disease. And, well, that doesn't seem to be the case from everything we know about cognitive reserve. One thing is the pathology. The other thing, what really matters from an individual perspective, and from a public health perspective, is the manifestation of the symptoms. If we could delay those, that itself, from my perspective, is the real outcome, is not the plaques and tangles. I don't care about tangles, I care about functionality.[9]

Therefore, it is surprising that lab-based tests would be acceptable indicators of functionality rather than everyday tasks, which would require transfer effects. He seems to be fighting against a biomedical foe that is looking for signs of a pathologically free brain when the biomedical standard bearer, the State-of-the-

[9] For multiple references on this topic, see Fernandez and Goldberg, *The SharpBrains Guide to Brain Fitness*, 32-41.

Science Panel would likely have been satisfied with unambiguous transfer effects on several indicators of daily functioning (self-rated IADL difficulty as well as the daily tasks associated with the lab-based tests).

Fernandez does also suggest that bias may be in the way of reading evidence neutrally. One form of bias, he suggests, may be the poor reputation of Nintendo's Brain Age game that seems to have unfairly tainted the whole category of brain fitness products. He suggests that because of this skepticism, any scientific study in this area has to meet impossible expectation; it has to be a "magic pill" in a science research environment. The irony is that scientists are the ones who remind the unscientific public that there is no magic pill, so Fernandez seems to suggest that even scientists are affected by what Crossman called "opinions and values" in evaluating evidence.

Fernandez argues that cognitive health is the frontier of public health, taking its place behind vascular health which has been so successfully prevented and delayed. But elsewhere in the interview he expressed disappointment that "Right now there's absolutely nothing serious or concerted or powerful in terms of cognitive public health, as I think it should be and I'm sure that it will be some day." He acknowledged that the HBI has "a wonderful web site and sometimes we go there, but no, the reality is that I could not say any accomplishment of the Initiative." He also believed that industry should be involved in discussions at the national policy level but was not aware of any such involvement.

Dr. Michael Merzenich also belongs to the brain fitness industry, as the founder and CEO of Posit Science, an early market entrant in 2003. The

company produces three products that they claim are evidence-based: InSight, visual processing software for better perception, focus, and reaction time, and Drivesharp, a subset of InSight designed to improve driving skills; both incorporate the licensed Useful Field of View technology from Visual Awareness, Inc., that was tested in the processing speed component of ACTIVE. Posit's third and probably best known product is its Brain Fitness Program, which works on auditory rather than visual processing abilities in adaptive listening exercises that claim to increase ability to distinguish sounds at increasingly fast speeds. The product has been prominently featured by the Public Broadcasting Service in programs on Brain Fitness and is offered as a gift in exchange for a PBS donation. This product also claims support from the previously discussed IMPACT Trial and related studies.

Posit's products work differently from many others and are based on Merzenich's neuroscientific research on speed of processing (Salthouse's construct). Therefore it addresses a more basic level of physiology, what Merzenich calls "operational characteristics" of the organism, which affect all subsequent actions in a person's life. Posit Science's web site product page asserts, "Posit Science's brain training software programs speed up and sharpen the brain from the roots up. They are clinically proven by independent researchers to help people think faster, focus better, and remember more. These improvements help you be your best for whatever matters to you—at work, with family and friends, in life."[10]

[10] "Brain Training Products," PositScience website, http://www.positscience.com/brain-training-products (accessed May 26, 2012).

The following passage outlines Merzenich's own *Evidence-Based Policy Argument* suggesting public health recommendations for cognitive exercise.

Michael Merzenich

> I strongly believe that if you trained older people in the right way, intensely enough, and as we evolve this, older people would in a sense have a much more important and prominent role to play in society because they have something a young person can't easily acquire – they have a lifetime of acquired information and knowledge and they have the wisdom that comes from manipulating it in their brain and thought a zillion and one ways that a young person just can't come up with. So if they were more advantaged in operating, again, with greater fluency, with greater accuracy, or if they never lost it, better still, from a young life you basically maintain your brain health in a better way so that you don't decline in those ways quite so rapidly, that could make a tremendous difference in what the older people in our societies can bring to the table for the benefit of everybody (mostly to their own benefit).
>
> ...We have a tremendous tragic human harvest, we have a tremendous population of people that are under someone else's care in their older age, we have a tremendous societal cost, we have tremendous loss and waste of years, of people whose bodies are still alive but their brains are dead, we have incredible actual direct medical cost and suffering in all of these things, it's probably, in terms of public health, probably *the* number one issue. You know, we have an aging population that lives too long, in which their brains don't live as long as their bodies. And there's all of this talk about increasing lifespan. If that's done without increasing brain span, it's all a bust.
>
> ...I had sort of a mixed reaction to [the State-of-the-Science Conference and statement]. I thought that anything like that is good because it gets people to talk about this and the potential of this area to grow and the circumstances of what could grow, and I thought parts of it were sort of amazing in the sense of people's understandings of what has happened and what is happening in the real world. Part of this is if you get any group of 100 or 200 scientists together there are always some people that are in the know and pretty advanced in how they look at these things neurologically and then there are other people that aren't. So it's noisy, you know the process is noisy....Several people said that we have no example of a brain training program that's really been shown to work to improve cognitive health. The NIA itself has supported very compelling studies, for example, if you look at the

extension of the studies that were conducted in the ACTIVE trial ... People trained in Karlene Ball's thing for 10 hours, you can show the impact 5 years later on the cost per annum for healthcare, on the incidence of the onset of depression in that fifth year for God's sake.... It's very frustrating to me as a witness of it to see that so little is invested in a potential class of powerful solutions, solutions is the wrong word – powerful assistive strategies... The public does not have any conception of what they should be doing in life because science doesn't inform them and the government authority doesn't inform them. Nobody informs them.

...I think we're in the early phase of a revolution that's already in a sense in process but that most of the people, even the people that should be in the know, are still unaware of the depth or the power of it. Again, I just described an experiment in which I took an animal near the end of life, I looked in its brain and saw that everything was different, everything was degraded, I trained it and everything got better – *everything* got better. That's the basis of a fundamental change. Just understanding that the brain is fundamentally plastic, just understanding that I can take any basic aspect of its operation in an animal at least, well in a human too because we've done this over and over in humans, and I can look at its operational characteristics, how it's doing this thing and I can drive it to improve it so that it can do it as if it's much younger.

What does that mean to people? What needs to be proven? You could say if I show that I did something for ten hours and I show five years later that people are having half as many driving accidents, are much less likely to develop depression, are much more likely to still be independent, and are costing $250 a year less on their insurance, what more do I have to prove that says that that ten hours is well spent and valuable? So when I hear somebody say that nothing is proven scientifically, I'm saying that's just ridiculous. Of course things have been shown to work.... Meanwhile, by the way, people fall over the dam because they don't do things that could be good for their brain health because people like this say it ain't ready for prime time.

We did a trial in which we trained 200-some people, and it was run by a guy from the Mayo Clinic, definitely not subject to influence or bribery, co-authored by a woman from USC. This was done independently of us. It cost us a million bucks. We demonstrated beyond a shadow of a doubt that if you did this thing you had improvements of your cognitive ability that translated to a difference of about 11 years in your cognitive status on these broad-scale measures and that translated to significant improvements in quality of life, that everybody didn't get better but the majority of people that trained did, and that the

> differences were substantial. That was done according to a straight-laced and like an FDA trial, but people somehow, that's not enough. It's one of the reasons why I sometimes wonder if only a fool does a control trial in a commercial arena like this because nobody else does. And it's given no credence or value....
>
> People imagine that these health solutions are going to come from particular sources and there are powerful forces that have invested heavily in that. You know, the development of drugs that deal with the systems in older life is a multi-billion dollar investment, and people imagine that, everyone is sort of waiting for the drug that will save them before they fall over the cliff. It's how doctors think about it, it's how individuals think about it, and societies, they don't *really* believe that the things they could do, well increasingly they believe and that's part of the groundswell.... I think in ten years we'll look back at this and it'll (I hope, if I'm still around) be a little bit amusing, because I think this is going to be everywhere. I think this is *so* obvious and it's so obvious that people are going to learn this lesson in the next decade.[11]

Merzenich begins this passage by juxtaposing a bright vision of a world in which old people are active participants with the advantages of youth and old age against a dark vision of the current world in which they are vegetables warehoused in institutions. The rhetorical power of the juxtaposition would push any listener to endorse the first vision. Although one does wonder, is this a fantasy? Is it realistic for one age (old age) to have the benefits of two (wisdom *and* speed of processing)?

Merzenich applauds the State-of-the-Science Conference review but not necessarily its conclusion. Even stronger than Merzenich's characterization ("Several people said that we have no example of a brain training program that's really been shown to work to improve cognitive health"), the State-of-the-Science Conference Statement concluded was that there was not enough evidence to recommend brain fitness. Merzenich points to the NIH-funded ACTIVE Trial as

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[11] Michael Merzenich, interview by author, San Francisco, October 3, 2011.

the study that showed the effectiveness of the Useful Field of View product that Posit later licensed for some of its products.

In mentioning the ACTIVE research, Merzenich alluded to a set of at least four articles by Dr. Frederic D. Wolinsky, et al., that extrapolate from the findings of the ACTIVE trial on secondary outcomes measured in the study. These are downstream measures that are closely linked to the healthcare system and the American economy. On two of the articles Wolinsky was a consultant for Posit Science and another author, Henry W. Mahncke was Posit Science's Vice President for Research and Outcomes. In 2007 Posit Science had licensed the Useful Field of View instrument to train speed of processing and has embedded it in Posit Science's visual training products. Of the articles, three link the speed of processing cognitive training and better self-rated health-related quality of life at 2, 3, and 5 year follow-ups.[12] Self-rated health has been found to be predictive of mortality and functional limitation.[13] Other reports link the speed-of-processing intervention to a lower incidence of depressive symptoms at 1 and 5 years post-baseline[14] and so, hypothetically, to the predicted annual predicted medical

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[12] Fredric D Wolinsky, Henry W Mahncke, Mark Kosinski, Frederick W Unverzagt, David M Smith, Richard N Jones, Anne Stoddard, and Sharon L Tennstedt, "The Effects of the ACTIVE Cognitive Training Trial on Clinically Relevant Declines in Health-Related Quality of Life," *Journal of Gerontology: Social Sciences* 61B, no. 5, S281–S287; Fredric D Wolinsky, Frederick W Unverzagt, David M Smith, Richard N Jones, Anne Stoddard, and Sharon L Tennstedt, "The ACTIVE Cognitive Training Trial and Health-Related Quality of Life: Protection that Lasts for 5 years," *Journal of Gerontology: Biological Sciences Medical Sciences* 61, no. 12 (2006): 1324-9; Fredric D. Wolinsky, Mark W. Vander Weg, Rene Martin, Frederick W. Unverzagt, Karlene K. Ball, Richard N. Jones, and Sharon L. Tennstedt, "The ACTIVE Cognitive Training Trial and Predicted Medical Expenditures," *BMC Health Services Research* 9, no. 109 (2009), 1-9.

[13] Ellen L. Idler, Louise B. Russell, and Diane Davis, "Survival, Functional Limitations, and Self-rated Health in the NHANES I Epidemiologic Follow-up Study, 1992. First National Health and Nutrition Examination Survey," *American Journal of Epidemiology* 152, no. 9 (2000): 874-83; Ellen L. Idler and Stanislav V. Kasl, "Self-ratings of Health: Do They also Predict Change in Functional Ability?" *Journal of Gerontology Psychological Sciences Social Sciences* 50, no. 6 (1995): S344-53.

[14] Fredric D. Wolinsky, Mark W. Vander Weg, Rene Martin, Frederick W. Unverzagt,

expenditures related to these better outcomes. While using logic to extrapolate benefits, this line of thinking depends on the strength of the ACTIVE Trial findings which remain disputed.

Merzenich uses the ACTIVE evidence to support his claim that *Cognitive training with Brain Fitness software improves cognitive ability in older adults.* Later he brings up IMPACT ("We did a trial in which we trained 200-some people, and it was run by a guy from the Mayo Clinic, definitely not subject to influence or bribery, co-authored by a woman from USC"). As his introduction makes clear, conflict of interest has been an issue to others evaluating the evidence and he uses accreditations to bolster the legitimacy of the study. His words suggest that paying for a study within the commercial world is not considered credible and will have to be duplicated by federally funded (i.e., "neutral") studies. At the same time, the findings of the State-of-the-Science Conference and the previous funding record make one wonder if such "pure" evidence could ever be accumulated as "little is invested in a potential class of powerful ... assistive strategies."

Like Fernandez, Merzenich suggests that the drug paradigm, the model to which behavioral studies such as cognitive fitness interventions must conform ("That was done according to a straight-laced and like an FDA trial"), has blinded funding agencies to the merits of behavioral interventions ("but ... somehow, that's not enough"). He suggests that the convention is not applied equally to behavioral trials and drug trials, that the standard is much higher for the former.

Karlene K. Ball , Richard N. Jones, and Sharon L. Tennstedt, "The Effect of Speed-of-Processing Training on Depressive Symptoms in ACTIVE," *Journal of Gerontology Biological Sciences Medical Sciences* 64, no. 4 (April 2009): 468-72.

The blindness is due to *a priori* determinations ("People imagine that these health solutions are going to come from particular sources and there are powerful forces that have invested heavily in that") as well as to self-interest ("the development of drugs that deal with the systems in older life is a multi-billion dollar investment"). They also have trouble imaging the new paradigm of cognitive plasticity which represents a "revolution."

However, again, the IMPACT Trial had limitations. IMPACT was not evaluated in the State-of-the-Science Conference because of lack of followup of at least two years. Results particularly touted by Posit Science in its marketing materials are that there was an average increase of 131% in processing speed in the experimental training group.[15] It is not clear how they derived this result. As mentioned earlier, the finding that the experimental trial participants had an average drop in processing time of 68 milliseconds from a mean of 116 milliseconds (with huge standard deviation) to a mean of 48 milliseconds, or 60 milliseconds (.006) better than the improvements made by the active control group represent incomprehensibly small and meaningless amounts. Again it is based on the warrant that neuropsychological tests and self-reports are adequate evidence for transfer effects. That is, lab research and self-reports go beyond laboratory improvements to indicate better cognitive performance in life. Posit Science's arguments rests on convincing us of this transfer. To support this warrant, the Posit promotional literature states that

> The Posit Science roots-up approach emphasizes 'generalization,' or the extension of benefits beyond the trained

[15] "Focus on: The IMPACT Study," PositScience website, http://www.positscience.com/why-brainhq/world-class-science/peer-reviewed-research/impact-study (accessed November 7, 2012).

> task. Here's an example: Using a program in which you practice remembering a grocery list may help you get better at remembering grocery lists. With Posit Science programs, you may not ever practice grocery lists. By exercising the roots of memory, however, you will likely find that not only can you remember grocery lists better, you can also remember conversations with your neighbor, tasks at work, a movie you saw over the weekend, that word that is on the tip of your tongue and where you left your keys. These "generalized" changes are what improve quality of life.[16]

However, it would be difficult for most people to believe that a laboratory test on auditory processing speed would automatically lead to better social functioning without much stronger demonstration of how one leads to the other. Posit does not provide any backing for the warrant for why neuropsychological tests and self-reports represent such good evidence.

With estimated revenues of $25 million in 2009,[17] Posit Science seems to be reaching its target audience of healthy older adults. Dr. Merzenich called the public demand a "groundswell." One of the reasons may be that the company may understand what consumers are afraid of and how they are looking to stay engaged as they continue on with their aging lives. Plentiful examples of how life could be better with quicker memory speeds, conversation fluidity, a sense of organization and confidence depict a picture of successful aging that seems realistic and desirable.

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[16] "How Brain Training Works," PositScience website, http://www.positscience.com/science/how-training-works/brain-training-works (accessed May 26, 2012).

[17] SharpBrains, *The State of the Brain Fitness Market* 2010, 53-54

The Brain Gym

Lisa Schoonerman and her partner Jan Zivic started "vibrantBrains®, a Health Club for Your Brain ...where the sweat is figurative but the results are real" in San Francisco in late 2007. After doing research into therapies they became aware of a "nascent industry...that can help people either *regain* something that they'd lost or help [them] *preserve* something, or *enhance* it."[18] The gym is a physical place where people can go to work on cognitive skills using computer-based software programs such as Posit Science's Brain Fitness Program. The business also offers other forms of mental stimulation such as board games and reading material, guest speakers such as Alvaro Fernandez, and products to buy. Unlimited access to all materials is available for a monthly membership fee of $92. The services are available to any potential customer, and although Schoonerman was reluctant to discuss vibrantBrain's business model or clientele, she acknowledged in an interview that "...unless there is an event in somebody's life, an injury or stroke or something, most people don't really feel that there's a need until they reached an age where they are recognizing that perhaps their memory is failing or they're not as quick as they used to be or something like that. So, by default... it is mostly an age-related therapy."[19]

The vibrantBrains website offers an argument that we all need something like a brain gym to "live our lives to the fullest." The Science page reads in full:

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[18] Lisa Schoonerman, interview by author, San Francisco, July 1, 2010.
[19] Ibid.

What is the Scientific Basis for Brain Exercise?

We are living in the "age of the brain," a time of great scientific insight and discovery about what makes us tick and how. This ever-increasing body of knowledge about our minds is based on extensive and validated scientific research by world-respected scientists in multiple related fields and aided by technologies that enable scientists to look at the brain, through brain imaging, in real-time, to actually see what parts of the brain are working alone or together on what kinds of tasks. To learn more about almost every aspect of research recently conducted on the brain, you may want to consult Dana Foundation's excellent guide to brain health, which discusses both what we know about the brain and the mysteries scientists are still investigating.

For the last several decades, scientists from many disciplines, including neuroscientists, neurologists, psychologists, physicians specializing in treating both young and aging patients, speech pathologists, and others, have looked closely at how our brains develop, learn, age, and change. As importantly, they have hypothesized and conducted extensive, large, and numerous clinical trials and research studies to discover ways in which we can keep our brains healthy and vibrant throughout our lives. As a result, we now have an extensive foundation of scientific data about what we should do to keep fit and agile as we age. The research (Bronx Aging Study, Washington Heights Inwood Columbia Aging Study, and the Chicago Aging Study, to name a few) shows the importance of making wise lifestyle choices that include good nutrition, adequate sleep, stress management, regular physical exercise, regular interactions with others (or feeling part of a community), and consistent mental stimulation. We also know that we can even build up extra cognitive bench strength, called cognitive reserve, for use as needed (Dr. David Snowdon's highly readable, break-through study, Aging with Grace).

Consistent mental stimulation helps our brains to change, adapt, and create new neural pathways and connections, giving us an edge on maintaining a healthy and vibrant brain over time. There are two types of mental exercise: (l) acquiring knowledge, such as learning a new language, how to play a new musical instrument (or an old one better), traveling to a new place where food, history, culture, and even language cause us to adapt our old ways or learn new ones, reading a challenging book that gives us new insights, or taking a course in ancient history, for a small sampling; and (2) practicing the basic cognitive skills, such as memory, language, quantitative, reasoning and judgment, and spatial and visual skills, that help us acquire all the new knowledge outlined above more efficiently and effectively. We

> need both kinds of mental stimulation and exercise to maintain brain health and fitness. We now know that we need physical exercise in at least two complementary areas: aerobic and muscle toning and strengthening. Similarly, we need to constantly acquire new knowledge and hone the cognitive skills like memory, attention, and reasoning that help us acquire new knowledge or adapt to change and live our lives to their fullest.
>
> Sharpening our cognitive skills, such as memory, attention, and reasoning, through regular training and exercise is very much like practicing scales on the piano. We can play quickly and accurately when the music calls for it if we practiced the component parts enough. Our subconscious mind takes over and we automatically use these much-practiced skills to enable good piano playing. The same thing happens when we practice cognitive skills, such as memory, attention, and reasoning. When we need these skills to play Sudoku or argue politics or remember a shopping list or drive, these enabling skills kick in seemingly effortlessly, automatically, and seamlessly. Why? Because we have practiced them so much, we no longer have to think about them. They are simply there for us to use. That's the reason to sharpen and tone them through regular and consistent exercise as we age, to insure that these skills remain vibrant, fast and accurate. When we're focused on learning a new language or driving to see a friend or reading a complicated novel, these critical cognitive skills are unseen, gliding into action when we need them most.
>
> Recently, studies such as the large, NIH-supported ACTIVE Study have shown that practice on such key cognitive skills as reasoning, memory, and attention can translate to better driving, better financial decision-making, and higher everyday quality of life compared to those who did not practice these skills.[20]

VibrantBrain's passage suggests another *Evidence-Based Policy Argument*. It claims that *Consistent mental stimulation (practicing basic cognitive skills) can improve everyday cognitive functioning*. The first two paragraphs focus on the breadth of attention and evidence supporting the quality of our brain knowledge today. It is the "age of the brain" with knowledge "ever increasing" across "many disciplines" through "extensive and validated scientific research," "extensive,

[20] "What Is the Scientific Basis for Brain Exercise?" vibrantBrains website, http://www.vibrantbrains.com/science/what-is-the-scientific-basis-for-brain-exercise/ (accessed May 22, 2012).

large, and numerous clinical trials and research studies," yielding "an extensive foundation of scientific data." The passage describes this evidence in concrete terms because of technologies that "enable scientists to look at the brain" to study it in "real-time" rather than imagine or guess about it as in the pre-technology days. The repeated terms of magnitude set up an ethos of scientific authority supporting the theoretical claims made in the third and fourth paragraphs that brain exercise is qualitatively unique and important for brain health.

The passage sets up two tiers of mental exercise, which mirror the two intervention groups in the IMPACT Trial – knowledge acquisition on the one hand (as in IMPACT's history, art, and literature active control), and "basic cognitive skills, such as memory, language, quantitative reasoning and judgment, and spatial and visual skills" on the other. The passage further suggests under the fitness metaphor that the division may be like the division between aerobic exercise and strength training in a typical exercise gym. We need both but only recently has it been realized that "strength" in cognitive skills underlies more substantive knowledge acquisition. Without the basic abilities, the knowledge cannot easily be acquired, synthesized, and retained. Repetitive skill-based training is a process of "sharpening." An analogy might be sharpening a knife that can then be used, say, in culinary arts. It is a process of "practicing scales on the piano," getting the notes down so that they can be used to make music. Other skills can be trained and used to "argue politics" or "drive" (the other examples,

"remember a shopping list" or "play Sudoku seem oddly incommensurate in their importance[21]).

The passage's concluding paragraph brings together the argument that we need to "practice" what are "key cognitive skills" for "higher everyday quality of life," or as is said in a previous paragraph "to live life to the fullest." The main evidence given is ACTIVE, presented as though there are several such studies ("studies such as the large, NIH-supported ACTIVE Study..."). However, the pharmaceutical and biomedical evidence-based model, only requires one large successful RCT is needed to establish proof. The requirement to repeat the study would be financially crippling. So ACTIVE would be enough if the evidence did indeed show transfer effects described by this marketing literature ("better driving, better financial decision-making, and higher everyday quality of life"). In fact, as we have seen, transfer effects were limited and participants in the ACTIVE trial were not blinded to their condition, so that these findings were not conclusive.

In addition to the evidence-based argument and in keeping with their marketing purpose, the authors appeal to their readers by illustrating the mechanism behind "cognitive skill training" by making an analogy between physical bench strength and "cognitive bench strength, called cognitive reserve," referencing "Dr. David Snowdon's highly readable, break-through study" in the second paragraph. Although several studies are cited for why behavior matters for brain health, the passage places its emphasis on *Aging with Grace* (AKA "The

[21] The shopping list has a notable and odd staying power within cognitive psychology and neuropsychology. The example, I believe, trivializes the kinds of tasks that people do perform in later life – after all people typically plan their shopping trips and can and do write down grocery lists – there is very little need to memorize them.

Nun Study") as evidence for benefits of cognitive training specifically. According to the authors, cognitive reserve can then be used as a resource for cognitive performance.

The Nun Study is an unusual choice for evidence to support training on computer-based programs because it has nothing to do with such activities. However, the study does present strong epidemiological evidence suggesting that education and especially linguistic skill protect against the manifestation of Alzheimer's disease. Participants in the study were nuns between the ages of 75 and 102 who shared similar lifestyles (diet, lack of smoking, similar socioeconomic status, shared teaching profession, and so forth), providing researchers with built-in controls for many possible confounding factors. Researchers assessed the nuns' physical and cognitive functions every year and also autopsied brains at death. After the study had started the researchers discovered a cache of autobiographies written by the nuns at the average age of 22 years upon entry into the congregation. Analysis of these autobiographies correlated "idea density," a measure of the average number of ideas per ten words, with cognitive health late in life. Put negatively, those with low idea density autobiographies were much more likely to be functionally demented later in life and their brains to show a larger number of neurofibrillary tangles.[22] In his popular book, *Aging with Grace*, Dr. Snowdon suggests "brain reserve" as a possible theory underlying healthy cognitive functioning even in the presence of

[22] See Kathryn P. Riley, David A. Snowdon, Mark F. Desrosiers, and William R. Markesbery, "Early Life Linguistic Ability, Late Life Cognitive Function, and Neuropathology: Findings from the Nun Study," *Neurobiology of Aging* 26, no. 3 (March 2005): 341–347, as well as the popular text mentioned by Schoonerman, Snowdon, *Aging with Grace*, 2006.

pathology. The finding has been confirmed since by Engleman et al (2010).[23] To my knowledge, however, no one has *trained* people in linguistic complexity in order to promote cognitive reserve and then studied their subsequent brain health, although this would be a fascinating study. The Nun Study is well known for another feature not mentioned in this text: Snowdon found that cardiovascular disease was correlated with the manifestation of dementia, so that nuns who had had strokes were much more likely to manifest brain pathology in their everyday behavior.[24]

The theory of cognitive reserve is a compelling warrant for epidemiological data but there is a missing piece between the association found and the idea that behavior change can create cognitive reserve and improvements in cognitive functioning. The young nuns who had such high linguistic skill and were apparently protected from the manifestation of dementia even in the presence of pathology may have had structurally different brains from a young age that did not relate to their education or experiences in life. It could be that those with poor idea density could have done nothing different in their lives to change the outcome of dementia. The best evidence that behavior could change that outcome rests experimentally with the ACTIVE Trial, but such evidence falls short of proof.

A strength of the vibrantBrains model, found also in the Posit Science and SharpBrains texts, is an emerging picture of cognitive health. These companies, who are in dialogue with aging cognitive fitness consumers, attempt to reach this

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[23] Michal Engelman, Emily M. Agree, Lucy A. Meoni, and Michael J. Klag, "Propositional Density and Cognitive Function in Later Life: Findings from the Precursors Study," *Journal of Gerontology: Psychological Sciences, 65B, no. 6 (2010)*: 706–711.

[24] Snowdon, et al., "Brain Infarction and the Clinical Expression of Alzheimer Disease."

audience through meaningful examples. The vibrantBrains passage, for example, describes trainable cognitive skills as supporting the kind of meaningful cognitive activity that smart people presumably care about – learning a new language, playing a musical instrument, traveling, reading, and continuing education. Elsewhere the passage talks about "arguing politics" and "driving to see a friend" and "better financial decision-making." In an interview Ms. Schoonerman suggested other desirable forms of cognitive performance that might not come to mind in a culture that still separates physical and mental functioning, such as staying competitive at tennis. She also mentioned a woman who gained the confidence to date and eventually married a man who belonged to the exclusive IQ-based society Mensa International. From Schoonerman's perspective, cognitive health is self-defined in many different ways: "It's in line with what that person's goals are. And that's often the first question that we ask somebody when they come in, and they say oh well, what should I do, and we say, what are your goals? What is it you would like to change, or improve?"[25]

Schoonerman contrasted the pro-health perspective of the brain gym with what she regarded as the disease focus of many of the research and policy efforts:

> I will tell you that people who come in here and complete a program, most of those people self-report that they feel that they benefited in some way but it's a lot more difficult to quantify. Often it's a feeling, so, and I think are our standard neuropsych workups and things like that aren't really developed for things like this, they're developed for an entirely different purpose.... I really think that on the national level, if you're talking about the CDC, and the NIH, and things like that, it's more about things that people can do to stave off Alzheimer's disease, the mindset is really from the disease prevention perspective.[26]

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[25] Lisa Schoonerman, interview with author, San Francisco, July 1, 2010.
[26] Ibid.

According to Schoonerman, self reports are valid forms of evidence among her client base, which is seeking cognitive health, than neuropsychological tests, because the latter are designed to diagnose disease (despite some rhetoric of health promotion). She points to a gap between what her clients desire and what research and policy efforts measure. In addition, she acknowledged that the evidence could be better but felt that it was adequate: "I would also say that we need more evidence. But I happen to personally feel, and I'm not a scientist again, so maybe my opinion doesn't qualify here but I personally feel that there's *enough* evidence, I've done the programs myself, I feel that I've benefitted from them, and I'm a healthy individual."[27] Here Schoonerman seems to separate herself from the VibrantBrains website's more scientific sounding rhetoric. She offers the weakest of evidence, that personal experience is warrant enough to recommend behavior change to others. However, it seems clear that vibrantBrains innovatively fills a demand for age-related brain concerns that few mainstream institutions address.

"Be Well" Brain

The particular market segment in computerized brain training to which Alvaro Fernandez, Dr. Michael Merzenich, and Lisa Schoonerman belong is just one segment of a much older and broader market in cognitive health that encompasses stress management, movement therapy, nutrition, wellness coaching, and other lifestyle products and services. Dr. Nancy Emerson

[27] Ibid.

Lombardo represents many of these non-technological lifestyle interventions although she specializes in nutrition (see the Appendix for a more comprehensive description of her background). Her business HealthCare Insights, LLC, in Acton Massachusetts, offers a product called Memory Preservation Nutrition® (MPN™), a concentration of leafy green vegetables, whole grains, particular spices, and omega-three fatty acids, as well as a broader nutrition program to be implemented in institutions, consultation services for individuals and institutions, and presentations and workshops on the same material. Beyond her nutrition program, she gives presentations and consults on a broader Be Well program that includes nutrition, physical exercise, cognitive and mental stimulation, stress management, depression management, social support and interaction, and interventions to balance qui (acupuncture, acupressure, tai chi, and chi gong).[28] In her interview, represented by the passage below, Emerson Lombardo argues for behavior change on the basis of adequate evidence.

Nancy Emerson Lombardo

> [I]n the '90s some of the research started coming out that stroke and heart-related problems seemed to increase your risk of Alzheimer's dementia. Once that became clear, and the Nun Study helped with that too, once that became clear, then people said, "Aha! What causes these other chronic diseases that are increasing the risk of Alzheimer's? There's lifestyle going on." There's nutrition and exercise.... Because that work [on vascular and other chronic diseases] has been going on for more decades. It's just like a mathematical model. If A causes B, and B causes C, then A might cause C. Or maybe A causes both B and C. The Nun Study shows that yeah, if you have both vascular issues and stroke, *and* you have the Alzheimer's pathology going on, even if they were from separate causes, you're going to have dementia quicker and more likely than if you only had the Alzheimer's pathology.

[28] See Nancy Emerson Lombardo, "Evidence-Based Healthy Lifestyles to Lower Risk and Slow the Progression of Alzheimer's Disease," Health Care Insights Download Library, "Healthy Lifestyles," http://healthcareinsights.net/download-library/ (accessed May 28, 2012).

But what if, well, nutrition and exercise we know has a protective in stroke and almost every vascular issue, whether you're talking about blood pressure, cholesterol levels and problems, stroke, diabetes, all of those are related to nutrition, exercise, stress, and now we know sleep and a few other things, well, what if those have two ways of leading to an Alzheimer-type dementia, one it causes these other problems which in turn make you more vulnerable to your brain rotting and falling apart, but also has a direct effect in hastening the buildup of this problem a-beta....

I was very disappointed with that [State-of-the-Science Conference statement]. Very disappointed. I thought that was an example of looking backwards. They were being very, again researchers can be very careful and they were looking meta-analyses and they had very high standards of what trials to look at, and mostly they were looking, I think, at human trials. They did not look at the whole body of data....

... other people have shown the connection between heart health and blood sugar health with brain health. That connection's pretty clear....Most researchers think that. Anyway, what is very clearly proven is that these same foods that people are saying are good for the brain have been proven to be good for the heart, for cancer, for diabetes, for a whole list of other illnesses, so you wouldn't be doing people a disfavor to say, and this is how the Alzheimer's Association trying to be conservative said, follow the rules for a healthy heart, this was when the evidence was less, follow the rules for a healthy heart and you'll probably have a healthy brain. I think that they should have been looking at that, and making that case, that yes, the evidence here is growing, it's not where this other level of evidence is, but it turns out what people are saying over here is the same as what other people have proven is important for other organs in your body, which may if they didn't think for sure is related to your brain, well, they could say which some people think is related to your brain. But they didn't say that. They only emphasized the negative message. That's what I objected to.

...I don't know whether I call it conservatism or looking backwards or this drug culture but in Europe you don't find the reluctance to say look, this is what makes sense. You look at the whole huge body of evidence. This is what makes sense. Meanwhile, the drugs are really not going to do it. Once you figure out that the processes that lead to Alzheimer's, which are still mysterious, could take decades, are you really going to put someone on a drug, start them at 20 or 5 and have them take a drug for decades? In Europe they wouldn't go for that. They are looking for non-drug solutions. Not that they're anti-drug, not at all. In fact, it's easier to do drug studies in Europe than here. But they're more of this balanced approach, let's let pharmaceuticals

> do what they can do best and let's not forget that maybe we can prevent a whole bunch of this problem through healthy lifestyles. Let's see if that's the way to go. And if it is, then that's the way we want to go, even though nobody will be making money on it. It's going to save their economy. They're more able to look at the big picture, like okay, if you are just focused on a drug solution, haven't you figured out you're not going to be able to afford it? That this whole country could be bankrupt by the cost of care? And more and more, they're finding out that drugs probably don't work once you already have the illness.
>
> ... I think they [minority communities] get it that it's more in their control if they can, like [name of colleague] is just passionate about this, if you can get someone turned on to exercise and eating better then their own health is going to improve and they're more in control than if they're on 20-25 drugs. I mean, he was appalled to find out how many, once he started working with the elderly, how many drugs people would be on and all the side effects. It just doesn't make sense. And then you're spending all your money because of co-pays. If you're on Medicaid maybe you're lucky and you don't pay much, but most people are in between, and they have to choose between eating and paying for their drugs. It doesn't make sense. And a lot of people who are worried about health and drugs, like there are some groups not just minority folks but people in, well when [Medicare] Part D first happened, a lot of the senior activist groups around the country were very against the way Part D came down, and they figured out, if you want to have fewer drugs in your life you've got to take more responsibility for your own health. Again, I think that's something, maybe it's part of being outside the mainstream to realize you have more control over your life if you're not dependent on a drug and a doctor. Not that they should be your enemy, they're your friend too, but first of all you're going to have less pain and discomfort in your life, who wants to take 25 pills?[29]

In contrast to the three interviewees in the cognitive fitness industry, Emerson Lombardo uses a *Logically Derived Policy Argument* in favor of public health messages for cognitive health. Like several of the researchers, she starts with the blurring separation between Alzheimer's and vascular dementia, showing that the same risk factors for vascular disease affect Alzheimer's disease. She presents

[29] Nancy Emerson Lombardo, interview by author, Boston, MA, October 20, 2011.

two different ways that vascular factors are connected to dementia. One is by increasing the pathological burden to the point where Alzheimer's pathology is unmasked and results in dysfunctional behavior, as suggested by the Nun Study (people without the extra vascular issues tolerate and can work around Alzheimer's pathology, depending on their cognitive reserve). She also presents the scenario that vascular factors directly influence cognitive health, the data for the *Logically Derived Policy Argument*. Evidence collected over decades has further shown that nutrition, exercise, and stress reduction can reduce blood pressure, cholesterol levels, stroke, diabetes, and it can be assumed that the same evidence can be used to reduce or delay dementia. The warrant for using behavioral evidence for vascular health is that heart health is a factor in cognition ("If A causes B, and B causes C, then A might cause C"). Under the classic logic of this syllogism, C (cognitive decline or dementia) would follow A (risk factors such as high blood pressure) if B (vascular problems such as poor blood perfusion) causes C (cognitive decline follows from low blood perfusion). She suggests that the same argument might be able to be made with the behavioral evidence for type II diabetes. Preventing vascular risk factors (which cause "these other problems which in turn make you more vulnerable to your brain rotting and falling apart") would presumably reduce the incidence of dementia. Emerson Lombardo emphasizes logic in her argumentation. Her discourse was permeated with the phrases "It makes sense" and "It doesn't make sense." Including logic in the pantheon of legitimate epistemology methods makes *cognitive health promotion through vascular health promotion* seem obvious.

Emerson Lombardo stands apart from the others interviewed for this chapter because she is very close to low-income communities. Whereas for the most part the cognitive fitness industry targets high-end consumers who have the luxury to buy or rent use of software for their brain and have the time to practice cognitive skills, Emerson Lombardo deals in low-cost interventions that, according to her, speak to communities that are outside of the mainstream. In my interview with her, Emerson Lombardo described her work with communities reached through the Boston Housing Authority, as an investigator with the Boston University Alzheimer's Disease Center. Emerson Lombardo depicts a rift between brain experts, researchers in particular, and common folk.

Emerson Lombardo is well attuned to the economic burden of pharmaceuticals on American elders. Heavy reliance on pharmaceuticals as is common among elders, she argues, leaves people feeling out of control in their lives. In particular it creates economic competition between health needs (eating vs. taking medicine). Again she represents the professional expert, the physician, as an establishment authority that outsiders do not necessarily want to depend on for their cognitive health. At face value it is difficult for anyone to imagine completely trusting the process of ingesting multiple mysterious products that interact in ways that are not necessarily being studied or monitored beyond initial drug-by-drug FDA approval. Overall, Emerson Lombardo speaks from experience with dementia, community work at various levels, and common sense as a basis for providing the messages, services, and products that she believes people need and want.

Opportunity Costs

The three main arguments these practitioners make for health practice promotion for cognitive health based on evidence assessment are *Evidence-Based Policy Argument* (Fernandez, Merzenich, and VibrantBrains), and the *Logically Derived Policy Argument* (Emerson Lombardo). Three of those interviewed, Fernandez, Merzenich, and Emerson Lombardo, also urge action based on an *Opportunity Cost Argument*.

In a 2005 handout, which mentions Alzheimer's Association's Maintain Your Brain™ program, Emerson Lombardo's company Health Care Insights urges action both at the individual and at the policy level with the following statement:

> **Why We Need Public Health Awareness NOW**
>
> - Gold standard double blind clinical trial proof of preventive power of lifestyle changes will probably take too many years to save the baby boomer generation. They are of course important to pursue and do.
> - Mounting evidence is supportive of lifestyle approaches.
> - We need to move forward NOW to preserve brain health and to save lives.
> - Downside risk is we motivate people to make changes that improve other chronic diseases.
> - Other similar multi-factor programs developed as evidence explodes
>   - American Society of Aging's Mind Alert Program-started in 2000
>   - Gary Small MD, PhD at UCLA
>   - Paul Nussbaum PhD at University of Pittsburgh[30]

[30] "Why We Need Public Health Awareness Now," handout from slide from Nancy Emerson Lombardo, "Evidence-Based Healthy Lifestyles to Lower Risk and Slow the Progression of Alzheimer's Disease," Health Care Insights Download Library, "Healthy Lifestyles," http://healthcareinsights.net/download-library/ (accessed May 28, 2012).

The handout promotes Emerson Lombardo's Be Well program, which encompasses nutrition, physical exercise, mental stimulation, stress management, depression management, social support, and interventions to balance qui (acupuncture/acupressure, tai chi, and chi gong). The statement "we need to move forward now" likely suggests action in the form of messaging to encourage the use of these lifestyle interventions. The available "mounting evidence," though not conclusive, is adequate to support this claim, warranted by the urgency of an impending dementia epidemic. The warrant is backed by the widely held assumption that an epidemic is inevitable because of population aging. What might be considered inadequate for public health messaging, for a less devastating and less prevalent condition, is arguably adequate evidence to prevent dementia. The backing is that doing nothing will result in inevitable harm whereas doing something (i.e., recommending exercise and a low-fat diet, for example, for cognitive health) can result in no harm. Following the Hippocratic oath, one is obligated to issue a public health message recommending these behaviors.

The change to non-drug solutions could also reshape American society. After reading extensively in neuroscience before founding his business, Fernandez remembers reacting by thinking, "Wow, if these concepts are true, many things will have to change in education, in healthcare, in aging, because the emergence of noninvasive options to maintain cognitive functionality through the lifespan is going to be very important from a public health and a public education

perspective."[31] Tracking the worldwide cognitive fitness market, SharpBrains recorded that "a much stronger signal was coming from Canada and the UK." In contrast to the *Road Map*, Fernandez notes a 2008 call to action in the UK titled the *Foresight Report on Mental Capital and Mental Wellbeing*. The Foresight report was a national program to promote "mental capital" across the lifespan, starting at a young age and continuing through life through lifestyle behaviors. The report represents a large compilation of studies that show associations between lifestyle factors and what they call "mental capital," defined as a national resource. The epistemology behind the report seems to be that the strength of the association is enough to on some level promote the behaviors.

Fernandez elaborated on his skepticism with what he views as American exceptionalism by describing the pursuit of noninvasive approaches at the national level by other countries outside of the US. Whereas American medical systems frequently prescribe anti-depressants as a first-line response to depression, the Britain National Health Service has instituted a form of computerized cognitive therapy (rated by the British agency NICE as evidence-based) to develop capacities to modify thought patterns or self-regulate emotions.[32] To Fernandez, "from a public health perspective, that is very smart. One, because it controls costs much better. Second, because it really works much better than just waiting until there are very severe symptoms and then giving some antidepressants. So that from a practical perspective and policy is a huge opportunity that other countries are doing well. In the US we have not seen that

[31] Alvaro Fernandez, interview by author, Skype, September 13, 2011.
[32] Ibid.

level of, maybe, foresight or maybe getting all the needed key players together to do something systematic like that."[33] In another example, the Ontario government has partnered with industry to design and commercialize new technologies for cognitive health, such as computerized cognitive training. He attributes this noninvasive approach to the attempt to draw from a larger expert base: "[F]or some reason they have a more interdisciplinary group of policymakers. Our perception in the US is that there are too many silos, and people in NIH may talk to each other or academia but they don't talk that much to industry, industry just talks to itself, then the healthcare people and insurance providers are more obsessed with all of the reform with the new government in the US, so there is less cross-sector innovation."

The *Opportunity Cost Argument* draws on many points, from the blinders of one solution to the possibilities of another, to allowing some industries and not others to shape the cognitive health research agenda, to the structuring of all acceptable research solutions in the form of one solution, to funding choices that shut out lifestyle solutions, to the exorbitant cost of not intervening on low-cost lifestyle behavior interventions. The argument's claim is that the US cannot afford not to *immediately* invest in lifestyle solutions for cognitive health. The data supporting this claim is the escalating cost of the status quo – an expected epidemic of dementia rates with population aging, the price tag of pharmaceutical solutions, whether they fail as they so far have or whether they are successful and must be paid for, to missing and not developing low-cost lifestyle solutions that have widespread health benefits, empowering a

[33] Ibid.

populace to care for their own health, and others. The warrant that this lost potential supports the investment in lifestyle solutions is that finite resources must be weighed against the relative social benefits of various solutions. The backing for this warrant is that the status quo has so far thwarted full exploration of the lifestyle intervention approach.

The marketplace moves quickly, and it is easy to pick up on a sense of impatience across those interviewed for this chapter for official sanction of lifestyle behavior change in support of cognitive health. Meanwhile research and policy move more slowly.

Chapter 4

The Evolution of Cognitive Health Policy

The previous two chapters presented researcher and industry arguments for and against issuing behavioral health recommendations for cognitive health. A number of these interviewees made *Evidence-Based Policy Arguments* for or against recommendations, warranted by RCTs. Other arguments to support recommendations were warranted by additional types of evidence – epidemiology, triangulated evidence, and logically derived evidence. We return now to the policy arena where two arguments, an *Epistemologically Informed Policy Argument* for policy recommendations and an *Evidence-Based Policy Argument* against recommendations, respectively, open and close the debate about issuing public health recommendations at the national level. Putting these stances within the context of a flow of policy positions that moves the narrative from a focus on Alzheimer's disease to a focus on cognitive health and back again to a focus on Alzheimer's disease will show the significance of these arguments

within national policy and the opportunity for alternative arguments to help shape policy.

The evolution of a line of cognitive health policy from its inception at the Alzheimer's Association in 2003 to its uncertain position today is a story of tension between disease-focused and health-focused views of older adulthood. This chapter will lay out the story of this evolution in a series of documents, a "genre chain"[1] that moves from initial articulations of the concept of cognitive health to ambiguous and confused uses of the term in connection with decline, impairment, and disease to its final disappearance in the first draft of the new national brain health agenda, the 2011 National Alzheimer's Protection Act. Although each document was written for a different audience, each was instrumental in a larger national policy conversation about cognitive health and each helped to propel the story along. Ultimately it is likely the weakness of the *Epidemiologically Informed Policy Argument* and the absence of the Hybrid *Logically Derived Policy Argument* in national policy discourse that turned the table at least for the time being against behavioral recommendations for cognitive health.

[1] Norman Fairclough, *Analysing discourse*. (London: Routledge, 2003). Fairclough discusses the importance of analyzing a sequence of texts, such as workshop, internal report, and journal article, to understand how stakeholders choose amongst possible arguments to frame their agenda over time; and Norman Fairclough, "Peripheral Vision: Discourse Analysis in Organization Studies: The Case for Critical Realism," *Organization Studies, 26* (2005): 915-939. As Fairclough points out, emergent concepts constitute a reweaving of existing discourses, some of them external discourses that are decontextualized and then recontextualized within the context of the new discourse.

"A Major Killer"

Medical historians and sociologists broadly agree that Alzheimer's disease became a public health issue in the mid-1970s with the establishment of the National Institute on Aging (NIA). Age activism in the 1970s, spearheaded by NIA founding director Robert Butler, exposed assumptions behind the Alzheimer's disease label and socially reconstructed the concept. Butler had coined the term "ageism," and today we could say that it was a social environment of ageism that permitted the discovery of Alzheimer's disease in the first place. Because old people were expected to be senile, the relatively young 51-year-old Auguste Deter stood out to Dr. Alois Alzheimer in 1906 as an example of a new medical phenomenon.[2] Alzheimer examined her brain at autopsy and discovered the amyloid plaques and neurofibrillary fibers that are still considered the main indicators of the disease. If today we see the young Auguste Deter and the old Ronald Reagan as sharing the same disease, it is only because of the work done to unify the symptoms in the 1970s. This work shifted the relationship between the concepts of aging and disease and set the stage for the emerging concept of successful aging.

In establishing Alzheimer's disease as a "pre-senile" dementia in 1910, Emil Kraepelin reinforced the established category of senile dementia, a phenomenon of aging.[3] The concept of senility "contaminated" the prospect and

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[2] See Martha Holstein, "Aging, Culture, and the Framing of Alzheimer's Disease," in Whitehouse, et al., *Concepts of Alzheimer's Disease*, 165.

[3] Kraepelin created the eponym Alzheimer's disease in the 1910 8th edition of his textbook, *Pschiatrie: Ein Lehrbuch fur Studierende und Arzte*. See Hans Forstl, "Contributions of German Neuroscience to the Concept of Alzheimer Disease," in Whitehouse, et al., *Concepts of Alzheimer's Disease*, 73.

experience of aging, to use Jesse Ballenger's term,[4] because it condemned every aging person to that inevitability. As Butler's and others' work revealed an enormous heterogeneity across the aging experience, many older adults were seen to be not at all demented. With a mission to combat ageism, it became important to purify the experience of aging by driving a wedge between the concepts of aging and disease. According to Butler's successor at the NIA, T. Franklin Williams, if a change is universal and inevitable, it is considered "aging," whereas if a change is not, it is considered disease.[5] Alzheimer's researchers had long debated whether there was any qualitative difference between early- and late-onset dementia. As the momentum accelerated to establish the NIA (1974) and raise its stature to the level of other agencies within the National Institutes of Health, as well as to join together Alzheimer's advocacy groups to form the new Alzheimer's Disease and Related Disorders Association (1979) – later the Alzheimer's Association – research showing the similarities between dementias of the two age groups was highlighted.

Robert Katzman's 1976 editorial in *Archives of Neurology* established Alzheimer's disease as "a major killer,"[6] an epistemologically backed rhetorical move that is widely regarded as most effectively restructuring of the disease and aging border at this time. The editorial opens with the suggestion that Alzheimer's disease ranks as "the fourth or fifth most common cause of death in

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[4] Jesse Ballenger, "Beyond the Characteristic Plaques and Tangles: Mid-Twentieth Century U.S. Psychiatry and the Fight against Senility," in Whitehouse, et al., *Concepts of Alzheimer's Disease*, 98.

[5] Hans Forstl, "Contributions of German Neuroscience to the Concept of Alzheimer Disease" in Whitehouse, et al., *Concepts of Alzheimer's Disease*, 171.

[6] Robert Katzman's 1976 editorial from the *Archives of Neurology* has been reprinted: See Robert Katzman, "The Prevalence and Malignancy of Alzheimer Disease: A Major Killer," *Alzheimer's and Dementia* 4, no. 6 (2008): 378.

the United States."[7] Katzman explicitly lays out his claim in the subsequent paragraph:

> The argument that Alzheimer's disease is a major killer rests on the assumption that Alzheimer's disease and senile dementia are a single process and should, therefore, be considered a single disease....the fact remains that neither the clinician, the neuropathologist, nor the electron microscopist can distinguish between the two disorders, except by the age of the patient. Today the majority of workers in the field accept the identity of the two diseases. We believe it is time to drop the arbitrary age distinction and adopt the single designation, Alzheimer's disease.[8]

Katzman's claim that *Alzheimer disease is a major killer in the U.S.* is supported with statistics of those who die from pre-senile and senile dementia of the Alzheimer's type. The key to the argument, as stated by Katzman himself, is the warrant that "Alzheimer disease and senile dementia are a single process and should, therefore, be considered a single disease." The warrant is backed by clinical, neuropathological, and molecular similarities between the two diseases. The effect of the argument was to raise the profile of this disease from obscurity to the stature of "major killer" in the U.S.

Many people cite the 1976 editorial as seminal in advancing this argument to eventual consensus.[9] Through the acceptance of this conceptual and rhetorical move, the category of Alzheimer's disease grew exponentially by absorbing a much larger group of people who had formerly been considered "senile."

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[7] Here it cites Katzman and Karasu, "Differential diagnosis of dementia," in ed. W. Fields, *Neurological and Sensory Disorders in the Elderly* (1975).

[8] Katzman, "The Prevalence and Malignancy of Alzheimer Disease."

[9] See Jaber Gubrium, *Oldtimers and Alzheimer's: The Descriptive Organization of Senility* (Greenwich, CT: JAI Press, 1986); Patrick Fox, "From Senility to Alzheimer's Disease: The rise of the Alzheimer's Movement," *The Milbank quarterly* 67, no 1. (1989): 58-102; and Robert Katzman and Katherine L. Bick "The Rediscovery of Alzheimer Disease during the 1960s and 1970s," in Whitehouse, et al., *Concepts of Alzheimer's Disease*, 110, among others.

Katzman and others moved Alzheimer's disease from the margins and brought it into the national limelight as a public health issue. While the statement that AD is the fourth or fifth largest killer is exaggerated even by today's standards, the CDC now uses similar prevalence framing for introducing the disease.[10]

On a cultural level, the effect of medicalizing cognitive decline was to move the focus from aging to disease. Personified as an assassin in Katzman's editorial, the disease was framed as an enemy to be fought and conquered.[11] Driving a conceptual wedge between aging and disease offered hope that aging could be a positive and disease-free experience with relatively little cognitive decline. Jesse Ballenger describes the shift in Foucaultian terms: "[B]y the end of the 1970s, if senility had not been eradicated, as an earlier generation of gerontologist activists had dreamed, it had at least been thoroughly disciplined – relegated by biomedical scientists to various discrete, well-defined disease entities that, at least in theory, no longer contaminated the entire experience of aging."[12] However, as aging remains the biggest risk factor for dementia, it remains doubtful that there has been a net gain in respect for elders. As Ballenger continues, "[D]espite what clearly seem to be positive developments, the prospect of aging continued to generate anxiety and hostility. Despite the tone of optimism, among researchers and activists, AD as more carefully and rigorously defined and described by contemporary biomedicine, seems to create at least as

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[10] For example, the "*Executive Summary Progress Report on The CDC Healthy Brain Initiative 2006-2011*" starts with the words, "Alzheimer's disease is now the 6th leading cause of death among American adults aged 18 and older, and the 5th leading cause of death for those aged 65 and older."

[11] This language was taken up by the Alzheimer's Association in its an annual policy document called "The National Program to Conquer Alzheimer's Disease," which was used for lobbying purposes. Mike Splaine, interview by author, telephone, November 28, 2011.

[12] Whitehouse, et al., *Concepts of Alzheimer's Disease*, p. 98.

much public fear and loathing about old age as did the expansive concept of senility out of which it was carved."[13] Despite the consensus in gerontological circles and the mainstream, in reality the tension between age-related cognitive decline and disease has never been resolved and lives on across national discussions without much clarification.

If the developments of the 1970s put Alzheimer's disease on the public health map, what was it that put *cognitive health* on that map and how was the issue's importance introduced and argued?

"Maintain Your Brain"

In its *2003 Annual Report* the Alzheimer's Association announced its intention to "Encourage millions to improve their health maintenance with our new Maintain Your Brain™ consumer education campaign," one indication of a sea change at the organization.[14] The change was clear from the visual format, tone, and content of the report, which in previous years had featured portrayals of solidarity amid pain and suffering and a long list of donors but now sported a streamlined look and a hopeful message aimed at people who did not have Alzheimer's disease.

The previous *2002 Annual Report* titled "I have Alzheimer's" featured the voices of people with Alzheimer's disease such as Reverend George Brown of Cleveland, Ohio, whose full-page photo portrait was paired with the words "I

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[13] Ibid.

[14] Alzheimer's Association, *2003 Annual Report: Our Vision is a World without Alzheimer's* (Chicago: Alzheimer's Association, Inc., 2004), 5.

want to be seen as someone worthwhile. Someone with something to offer and to do." Reverend Brown's situation is described in some detail:

> Rev. George now requires in-home day care five days a week to help manage his disorientation and wandering. He takes comfort in listening to tapes of gospel music and ministry programs, including many of his own outreach sermons that were broadcast weekly to radio listeners. A national figure within the Baptist church as a result of his radio program and participation in ministry conventions, his legacy is respected and admired by many colleagues across the country...On his good days, Rev. George Brown can reflect on his 45 years as a Baptist minister and still be moved by the sounds of his mother's favorite hymn, "Take your burdens to the Lord and leave them there."[15]

Respectful and heartfelt in its unflinching depiction of a patient's predicament, this description gives the reader little assurance that the Reverend will get his wish to be seen as "Someone with something to offer and to do." Instead the Reverend appears to graciously and admirably accept the fate of the disease. Once "a national figure," the Reverend seems to be treated as though he is socially dead or he would not be asking "to be seen as someone worthwhile."

The tone of resignation, the muddy colors, and low-tech grainy texture of the 2002 report were dramatically replaced in FY2003 with a new report produced by the new President and CEO Sheldon Goldberg's administration. It featured successive headlines announcing "Our vision is a world without Alzheimer's," "Our work is about people and science," and "We see progress and hope" announced that it was "re-branding" the organization to reach a wider public. Part of the report's new streamlined look was a new logo that featured lines looping up around a man's head and then in reverse down around a beaker

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[15] Alzheimer's Association, *2002 Annual Report: I Have Alzheimer's* (Chicago: Alzheimer's Association, Inc., 2002), 10-12.

next to him. CDC HAP Director Lynda Anderson described the change as profound: "The symbol of the Alzheimer's Association was people *all leaning together* in this very kind of dark way once the person had been diagnosed with Alzheimer's disease... Really very hopeless, feeling helpless."[16] According to Anderson, beginning to look at different aspects of Alzheimer's disease, "not just the end point [dementia] but thinking about other endpoints as well, they changed their symbol to be both the combination of science and people" (see Figure 4.1).

Fig. 4.1. Alzheimer's Associations logos. Top: Old logo for the Alzheimer's Association, Middle: New logo for the Alzheimer's association, Bottom: Symbolism of the new logo explained visually as "People" and "Science." The logos come from the Alzheimer's Associations 2002 and 2003 annual reports, respectively.

Included in this re-branding was a new aim to "encourage millions to improve their health maintenance with our new Maintain Your Brain™ consumer

[16] Lynda Anderson, interview by author, Atlanta, GA, August 31, 2010.

education campaign." It is probably not coincidence that the rebranding came on the heels of the Association's first reported drop in revenue in 23 years, from $73 million in FY 2002 to $66 million in FY 2003, perhaps indicating that the Association's constituency might be waning.

By 2004 the annual report titled "We're changing the way people think about Alzheimer's" could describe and explain an established Maintain Your Brain™ campaign. The argument on behalf of this approach was laid out in this report:

> Growing evidence suggests that lifestyle can affect brain health and risk for dementia. The Alzheimer's Association is reaching out to people with a public awareness campaign reinforcing the message that Alzheimer's disease is not a normal part of aging -- you can fight it if you Maintain Your Brain™.
>
> All of us can benefit by keeping our minds and bodies active as we age. The time to take account of lifestyle factors is now, especially for baby boomers (those born 1946 to 1964) who are about to enter the age of greatest risk for dementia.
>
> To deliver our healthy-aging message to those who need it most, the Alzheimer's Association will conduct informational workshops across the country, beginning in 2005. Called "Maintain Your Brain: How to Live a Brain Healthy Lifestyle," these workshops will focus on preventive techniques and outline diet, exercise, social and mental activities that may reduce the risk of dementia.[17]

The Association's claim here is that people can benefit from the new Maintain Your Brain™ consumer education campaign that teaches a "brain healthy lifestyle." The claim is supported weakly by vague statements that "growing" evidence "suggests" that behavior can "affect" brain health. These

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[17] Alzheimer's Association, *2004 Annual Report: We're Changing the Way People Think about Alzheimer's* (Chicago: Alzheimer's Association, Inc., 2004), 10.

behaviors including diet, exercise, social and mental activities, which "may" reduce the risk of dementia. The rest of the argument is not fleshed out.

The "10 ways to Maintain Your Brain" include "Take brain health to heart" which states that "Heart disease, high blood pressure, diabetes and stroke can increase your risk of Alzheimer's." and "Your numbers count" which advises readers to "Keep your body weight, blood pressure, cholesterol, and blood sugar levels within recommended ranges." The two ways to maintain brain health work together as an argument. The claim is that keeping body weight, blood pressure, cholesterol, and blood sugar levels under control will reduce risk of Alzheimer's. The support for the claim is that obesity, hypertension, high cholesterol, and diabetes increase risk of Alzheimer's. The warrant is that doing something about the risk factors for Alzheimer's will reduce the risk. Such efficacy had not in fact been proven.

The campaign was supported by a bold marketing campaign. As stated in the annual report: "Exciting and attention-grabbing ads were created and introduced mid-year, appearing in newspapers, on radio and on select Web sites through the remainder of the fiscal year. They were very effective in publicly repositioning the Association and starting to change the way people think about Alzheimer's disease – and they created quite a buzz."[18] The report states that the Association's news coverage nearly doubled in the year and that its web site traffic shot up during the year. The Association reported that revenues were returning to their upward trajectory at $68.3 million.

[18] Ibid., 4.

To put this argument in context of past thinking, the *2001 Annual Report* depicted Alzheimer's disease as an unlucky and somewhat random stroke of fate: "An 'equal opportunity disease,' Alzheimer's does not discriminate on the basis of race, gender, culture, or income."[19] Any differences in prevalence among sub-populations had to do with the fact that certain communities have less access to knowledge, education, services: "Anyone can develop AD. Whether home in the South Side of Chicago, a coastal town in Central America, or a village in central Africa, Alzheimer's is part of the neighborhood. The disease knows no borders, nor does it discriminate based on ethnicity, race, religious affiliation, socioeconomic class, sex, or sexual preference,"[20] strikes at random (perhaps because of genetic mutations) and signifies inevitable doom. The only possible hope appeared to be medical or pharmacological intervention.

In FY 2005, the 25th anniversary of the Alzheimer's Association, the organization announced that it was changing its mission from "*To eliminate Alzheimer's disease through the advancement of research and to enhance care and support for individuals, their families and caregivers*" to "*To eliminate Alzheimer's disease through the advancement of research; to provide and enhance care and support for all affected; and to reduce the risk of dementia through the promotion of brain health.*"[21] Former Director of State Policy and Advocacy Programs Mike Splaine called the new last line "a big change" for the

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[19] Alzheimer's Association, *2001 Annual Report: Saving Memories* (Chicago: Alzheimer's Association, Inc., 2001), 16.

[20] Ibid., 12.

[21] Alzheimer's Association, *2005 Annual Report: We're Advancing Progress in Prevention, Treatment, and Living with Alzheimer's* (Chicago: Alzheimer's Association, 2006).

organization.[22] Dr. Stephen McConnell concurred that the shift to health promotion "was the huge leap."[23] According to McConnell, the Association negotiated the campaign extensively with their scientific advisors and toned down its language to the point where everyone was comfortable.

All of these efforts by the Alzheimer's Association to rebrand itself moved the Association closer to its alliance with CDC. The same evidence that drove the Maintain Your Brain™ campaign in the program office in Chicago was used by public policy advocates at the Association's Washington, DC, office to argue for congressional funding for cognitive health promotion. According to the former Alzheimer's Association Vice President for Advocacy and Public Policy Dr. McConnell, "our part of it was, we understood that a hopeful message sells in Congress, too. So we were happy to take the message to Congress, but we weren't the ones that developed it." Going to Congress pushed the argument for health promotion to a new national policy level.

Opening Argument: What's Good for Your Heart is Good for Your Brain

In an interview, Stephen McConnell described the rationale behind lobbying Congress for money that could be brought to CDC to launch a primary prevention effort:

> [T]he science began to give clues that there are risk factors common to Alzheimer's and to cardiovascular disease. So diabetes and obesity, high cholesterol levels, hypertension, all those things could contribute to heart disease are also risk

[22] Mike Splaine, interview by author, telephone, November 28, 2011.
[23] Stephen McConnell, interview by author, telephone, September 14, 2011.

factors for Alzheimer's. And I think when that science began to crystallize there was a sense that well gee, those are all things that are manageable to some degree, and if they are manageable, perhaps it's possible to prevent the disease, slow its progression, etc. And I think it was really the first time that there was a sense that there was *anything* you could do to stave off Alzheimer's disease. Prior to that time, the hope was that various drugs would be developed that could intervene, and of course the cholinesterase inhibitors were developed in the mid-90s, or at least approved for use starting in the mid-90s, but they were not in any way altering the course of the disease, they were symptomatic drugs. So everything up to that point, then, was pretty much a *fait accompli*. So this notion that you might be able to intervene was really important, and I think provided the opening for thinking about how do you get a message out to people and get them thinking about healthy brain, about preventing Alzheimer's, if you will, so that was a key breakthrough.

At the same time, I think there was a sense that Alzheimer's as an issue had hit a wall. It was so depressing and so discouraging and there really were no treatments that were very effective and people tend to tune out if they feel like there's no hope. So I think there was a desire to find something that could provide people with a sense of hope. So those two things came together and you had, on the one hand, the desire to give a positive message and on the other you had at least enough scientific evidence that it's possible that if you do something you could actually make a difference.

That was quite controversial within the Association because there were scientists who said it is way premature, the evidence of those things being risk factors did not equate with, you know, if you do something about those that it will in fact stave off the disease. So there was a lot of caution in the wording on all those documents, it was very carefully worked out with the science community. It was kind of a negotiation, really, so that we were not overstating the case. But at the same time that you could justify that there was enough evidence to make at least it wouldn't harm you if you got more exercise and ate healthier and got your numbers down. The fact of the matter is it probably would help your heart. And so there was a sense that even if we told people to do that and it didn't, at the end of the day, lead to a healthier brain, that it was not harmful and it actually would have other benefits. So that was kind of the negotiation with the science community.

...I think the fact that we had this evidence, we were able to take to Capitol Hill and convince the appropriators that

> there actually were some things that would fall within the CDC, particularly within the purview of prevention. We convinced them and so they put an item in, we worked it out with the CDC where the money would be split between the Alzheimer's Association and the CDC.[24]

From McConnell's narrative of how the momentum for lobbying Congress was built, we can more clearly sketch the Association's use of evidence. The fledgling argument was that heart healthy behaviors could promote cognitive health. As illustrated by McConnell, the main evidence marshaled to support this claim was "science" linking the same risk factors with both Alzheimer's disease and cardiovascular disease.

Supporting that claim were epidemiological associations between Alzheimer's and cardiovascular disease suggesting that controlling cardiovascular risk factors in ways that could help the heart would also have an effect on Alzheimer's disease. More conservatively stated, there was "enough evidence to make at least it wouldn't harm you if you got more exercise and ate healthier and got your numbers down." The claim that by extension we can prevent Alzheimer's disease by preventing or managing the risk factors for cardiovascular disease (high cholesterol, hypertension, diabetes, and obesity) is warranted by these overlapping associations. Backing for this warrant would be weak because epidemiological associations are considered preliminary evidence in science for further testing through intervention trials.

McConnell's narrative points to exciting new directions. At the very least, the connection suggested that a once-intractable entity (a "*fait accompli*") could now be viewed as alterable for the first time in a hopeful way. Under the very

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[24] Ibid.

best scenario, it might be argued that because of physiological overlap, preventive behaviors for heart disease could be leveraged on behalf of Alzheimer's disease, thereby exponentially expanding the impact of those behaviors. McConnell reinforced this view later with the statement that "we felt like because of the importance of cognitive health and the linkage with physical health, particularly things related to exercise and other risk factors for cardiovascular disease, that there was kind of a twofer." In other words, physical activity could be promoted on behalf of both vascular health and cognitive health, perhaps by two public health teams, two types of physicians, to two sets of information seeking consumers. It is clear from McConnell's words that the Association was interested in providing advice directly to the public ("messaging").

It has been hinted by others (e.g., Dr. Peter Rabins), and is not inconsistent with McConnell's words, that lobbying Congress for money was also an organization-serving move, aimed at expanding the Association's constituency. Bernard Berelson points to the distinction between explicit and implicit arguments.[25] In this case the implicit message of McConnell's words from the organization's point of view may be read as a bit different from the explicit one told from the societal perspective. The subtext of the explicit argument for CDC funding is the warrant that the public needs reaching. In McConnell's words, the evidence linking Alzheimer's with cardiovascular disease (a modifiable chronic condition) "provided the opening for thinking about how do you get a message out to people and get them thinking about healthy brain, about preventing

[25] Bernard Berelson, *Content Analysis in Communication Research* (Glencoe, Ill: Free Press, 1971). First printed 1952.

Alzheimer's, if you will, so that was a key breakthrough." With these words, McConnell suggests that the public is not thinking about brain health and that is unfortunate. To put it more cynically, they are not thinking at all about the Alzheimer's Association. McConnell admitted, "It was a way to expand interest so that people who are nowhere near Alzheimer's would tune into it, you know, contribute, be part of the organization, because it had a preventive connection." Both perspectives, the societal and the organizational, exist simultaneously and are an example of resource mobilization[26] in advocacy work.

Throughout McConnell's speech are qualifiers that the evidence is not proof *per se* but rather a possibility ("the science began to give clues," "those are all things that are manageable to some degree, and if they are manageable, perhaps it's possible to prevent the disease," "this notion that you might be able to intervene," "at least enough scientific evidence that it's possible that if you do something...."). With both the Maintain Your Brain™ and the organization's advocacy work for federal funding to pursue brain health initiatives, McConnell suggested an *Opportunity Cost Argument* as a rebuttal to the objections that the science was not adequate. By evoking the Hippocratic oath, McConnell and others in the Association provocatively challenged the medical profession on its own ethical pledge. Is it more harmful to issue a technically incorrect message (what's good for your heart turns out not to be good for your brain) or to stand on principle because an empirical truth has not been established and so prevent people from engaging in behavior that *might* help them?

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[26] This theory explains how collective action emerges. See Mayer N. Zald and John McCarthy, Resource, *Social Movements in Organizational Society* (New Brunswick, N.J.: Transaction Books, 1987).

"An Alzheimer's-specific Segment"

On September 15, 2004, the Senate Departments of Labor, Health and Human Services, and Education, and Related Agencies submitted their Appropriation Bill for FY 2005 (ending September 30, 2005) requesting $2 million "to establish an Alzheimer's Disease component of the Healthy Aging program." The Senate and House versions went to Conference where an allotment of $1.6 million was agreed upon while referencing the Senate Report's justifying language as follows:

> *Healthy Aging and Alzheimer's Disease*.—Recent preliminary studies suggest that some of the same strategies that preserve overall health may also help prevent or delay Alzheimer's disease and dementia. For example, epidemiological studies have revealed that individuals taking anti-inflammatory drugs to treat conditions such as arthritis appear to have a lower-than-expected occurrence of Alzheimer's disease. Furthermore, a growing body of evidence appears to link known risk factors for diabetes, heart disease, including high blood pressure and high cholesterol, and risk factors for Alzheimer's disease and dementia. Additionally, evidence supports that maintaining intellectual and physical activity and remaining socially connected may also help stave off dementia. In light of this information, the Committee strongly urges the CDC to work with the Alzheimer's Association to design and launch an Alzheimer's-specific segment of the Healthy Aging Program, to aggressively educate the public and health professionals as to ways to reduce the risks of developing Alzheimer's by maintaining a healthy lifestyle. The Committee has provided $2,000,000 for this initiative. CDC should also coordinate this effort with the National Institute on Aging and the Administration on Aging.[27]

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[27] *Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriation Bill, 2005*, 108th Cong., 2d sess. Senate Report 108–345, to accompany S. 2810 (September 15, 2004): 74-75. The budget for the fiscal year ending September 30, 2005 (Public Law 108-447) was passed December 8, 2004, reflecting the Conference Agreement on House Resolution 4818 Consolidated Appropriations Act, 2005, passed November 19, 2004.

As demonstrated above, the final language of the bill stayed close to the argument advanced by McConnell, claiming that *the U.S. should establish an Alzheimer's disease-specific segment of the Healthy Aging Program*. Again, the evidence for the claim is the "growing body of evidence" that "appears to link" risk factors for Alzheimer's disease with those for other chronic diseases as well as evidence not mentioned by McConnell that social, physical, and mental engagement may help the brain. The warrant is again that overlapping associations suggest that common behaviors will prevent various diseases. This document backs the statement with a single example, that anti-inflammatory drugs for arthritis are associated with lower incidence of Alzheimer's disease. The use of secondary biomedical prevention techniques differs from the later intent of the HBI. The fact that the title of the line item combines "Healthy Aging" and "Alzheimer's disease" raises questions about the intent behind the program – was it Alzheimer's or promoting health? It would be up to the CDC to renegotiate an "Alzheimer's segment" within the context of health promotion.

The Cognitive and Emotional Health Project

The Congressional language made it clear that the CDC should work with the NIH (the NIA in particular) to further research into cognitive health interventions. The recommendation came on the heels of the completion of the trans-NIH Cognitive and Emotional Health Project (CEHP), which was just writing up its findings in 2006. The project had started even earlier, in 2001,

when several organizations at the NIH, including the National Institute of Neurological Disorders and Stroke (NINDS), the National Institute on Aging (NIA), and the National Institute of Mental Health (NIMH) launched an information gathering effort to examine research that had been done on maintaining or developing healthy brain function. The group held an international workshop in July 2001 and concluded that a formal critical analysis of existing studies was needed before issuing recommendations for further research. This critical committee was formed in 2003 and chaired by Dr. Hugh Hendrie. One of its first tasks was to establish selection criteria and a framework to be imposed on the studies found for comparative purposes. They chose to look at longitudinal studies where at least one cognitive and one emotional function were examined at baseline and in one or more follow-up waves. The studies were to include more than 500 participants and include participants age 65 and older. The outcomes of interest were performance related [i.e., related to health] "rather than clinically defined outcomes, such as dementia, mild cognitive impairment, and AD."[28] An initial focus on NIH-funded studies was widened to include other studies from around the world.

The study identified 36 studies that listed 52 cognitive factors and 46 emotional factors related to healthy aging. Separating out the cognitive factors, they found the most consistent reporting on the following protective factors: Higher education levels, higher socioeconomic status, emotional support, better baseline cognitive function, better lung capacity, more physical exercise, moderate alcohol use, and use of vitamin supplements. Lifestyle risk factors

[28] Hendrie et al., *CEHP Report*, 15.

most consistently reported were high blood pressure, diabetes, stroke, presence of infarcts or white matter lesions, depression, and higher body mass index. The report recommended that the study be followed by a larger systematic review: "This report is ... primarily focused on very strong findings, repeatedly observed in multiple studies in a variety of different communities and populations. There would be great value now in conducting a systematic meta-analysis of each of the risk factors identified in our study."[29] Such a statement was perhaps one of the seeds for the idea of the State-of-the-Science Conference that was eventually held in April 2010. The authors noted the difficulties of studying both emotional and cognitive outcomes when they were often not investigated together, of extrapolating findings on desired outcomes from studies that were conducted with a main focus on other outcomes, and in particular extrapolating findings for health from studies with a negative disease focus. The authors explained the latter limitation as coming directly from institutional priorities:

> The reason for the relatively fewer number of published reports on these outcomes from this group of very productive investigators likely is that the primary focus of most of these studies was disease-oriented (involving the dementias, AD, Major Depressive Disorder) so that analyses on nondisease outcomes was a lower priority. This disease-oriented focus is represented in the current priorities of NIH.[30]

Indeed, the most notable aspect of the CEHP was its crusading role on behalf of health (not disease) research. One of the few examples of health research was the MacArthur Study of Successful Aging. Noting that the concept of successful aging had been too little studied, the authors argued that a single

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[29] Ibid., 26.
[30] Ibid., 12.

model of successful aging (such as the MacArthur's Rowe & Kahn model) cannot suffice: "Current expectations for healthy cognitive aging may be too restrictive, based as they are on a survival cohort of hardy individuals who overcame great odds to reach the eighth decade of life or beyond. As we look into the 21st century and the prospect of older adults with a much broader range of physiologic and psychosocial functioning surviving into the eight decade and beyond, these expectations may well change."[31] The words point to an opportunity to better define the concept of "successful aging" and its outcomes.

The introduction to the CEHP report offers a full rationale for the investigation, beginning with definitions of cognitive and emotional health, differences between disease prevention and health promotion perspectives, and an attempt to position aging within the context of health and disease processes.

> There is as yet no universally accepted definition of what constitutes cognitive and emotional health in the older adult. The definition of cognitive health adopted by the Critical Evaluation Study Committee was that cognitive health as it pertains to the older adult should be defined not just as the absence of disease, but rather as the development and preservation of the multidimensional cognitive structure that allows the older adult to maintain social connectedness, an ongoing sense of purpose, and the abilities to function independently, to permit functional recovery from illness or injury, and to cope with residual functional deficits.
>
> A major component of many observational studies in this field of research is identifying risk factors that preserve cognitive function or prevent cognitive decline. Although risk factors for the major dementing disorders such as Alzheimer's disease (AD) will certainly be risk factors also for cognitive decline, it is conceivable that risk factors not specifically associated with AD or other dementing disorders may also be identified as factors for cognitive decline. For example, there are other common age-related non-AD pathophysiologic processes that could produce cognitive

[31] Ibid., 13.

> decline or cognitive impairment either singly or collectively, including milder forms of cerebrovascular disease or cell loss owing to oxidative stress, inflammation, or apoptosis. Studies of cognitive decline might therefore identify a different set of risk factors both genetic and environmental (or possibly place different weights on known risk factors) than would studies of single dementing disorders. Many of these processes may be preventable. Some cognitive processes decline almost inevitably even in healthy older adults. This has been attributed to "normal" aging. However, past experience with geriatric research should leave room for skepticism about attribution of any functional decline to "normal" processes.
>
> Significant cognitive decline is very common in the elderly population. Individuals with cognitive decline are at much greater risk for having dementing disorders. Thus, identification and early treatment of these individuals might prove to be a very effective strategy for preventing dementia. Cognitive reserve has been proposed as a mechanism to explain why some individuals may not exhibit the clinical manifestations of dementia while other individuals do with the same load of brain pathology. Cognitive reserve as measured, for example, by general intelligence, has been associated with higher occupational attainment and education as well as increased participation in intellectual, social, and physical activities. These observational findings suggest implementation of alternative or complementary strategies for reducing risk for dementia.[32]

These three paragraphs precede a discussion of successful aging, starting with the Rowe and Kahn model, moving to the Baltes and Baltes model as an emotional approach, and finally discussing Carstensen et al.'s socio-economic selectivity model,[33] representing a broad and inclusive treatment.

In this passage the CEHP Committee notes that they are venturing into undeveloped conceptual territory by stating that there is "as yet no universally accepted definition of what constitutes cognitive and emotional health in the

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[32] Hendrie et al., *CEHP Report*, 13.

[33] Corinna E. Lockenhoff and Laura L. Carstensen, "Socioemotional Selectivity Theory, Aging, and Health: The Increasingly Delicate Balance between Regulating Emotions and Making Tough Choices," *Journal of Personality* 72, no. 6 (December 2004):1395–424.

older adult." They begin with a discussion of cognitive health. The definition they offer echoes the WHO's 1948 definition of health in general as "more than the absence of disease" and even more than "preservation" to include the possibility of ongoing "development." This "multidimensional cognitive structure" is what enables functioning in society, which is explained as "social connectedness" and "the abilities to function independently," "ongoing sense of purpose," and a kind of resiliency in the face of illness or disability. In this framing, the CEHP report pushed the idea of health preservation further than Maintain Your Brain™ program, which coming from the Alzheimer's Association is never far from referencing the endpoint of Alzheimer's disease. After exploring initial desired outcomes, the Committee suggested that it expected that researchers should study these outcomes as distinct from disease outcomes. According to the text, age-related cognitive decline that is not as catastrophic as Alzheimer's disease and related disorders is common and needs to be acknowledged as a serious area of concern to older adults. The full range of patho-physiologic processes should be examined as well as protective factors that explain why some people can cope with brain pathology without becoming disabled.

Finally, the Committee recommends that

> The research community should ... pursue the avenue of brain health maintenance with as much vigor as is brought to the quest to understand the pathophysiology of brain disease. The committee wishes to emphasize, however, that the goals of health promotion and disease prevention are complementary and not conflicting. As our survey demonstrates, research into the factors involved with healthy brain aging has lagged well behind research into understanding brain disease. For example, information with

> regard to healthy brain aging had to be extrapolated from studies that had a predominantly disease-oriented focus. Given that the number and percentage of the old, and in particular the oldest old, are increasing exponentially in our population we hope that this report stimulates a discussion among the leading scientists involved in aging research, including the Institutes directly involved in this project, to map a future research agenda, which includes consideration of brain health maintenance as well as disease prevention.[34]

In this report the authors forcefully claim that *the critical concept of healthy brain aging and maintenance needs to be developed* because it "has lagged behind" other national research efforts. The evidence for this claim is the lack of research on cognitive and emotional aging that has a primary outcome of health. Most of the studies examined used an outcome of disease (dementias, AD, Major Depressive Disorder) and not healthy function. The warrant for the claim is that cognitive health "should be defined not just as the absence of disease, but rather as the development and preservation of the multidimensional cognitive structure that allows the older adult to maintain social connectedness, an ongoing sense of purpose, and the abilities to function independently, to permit functional recovery from illness or injury, and to cope with residual functional deficits...." The endpoints enumerated in this list potentially could coexist in the presence of disease and invoke the concept of cognitive reserve, which the authors raise to back their warrant. Protective factors may explain why some people do not exhibit the clinical manifestations of dementia while other individuals do show symptoms with the same load of brain pathology. The argument for the development of a concept of healthy brain aging and maintenance would go unchallenged but unanswered.

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[34] Hendrie et al., *CEHP Report*, 26.

The CEHP was at the publication stage when the Healthy Brain Initiative began and the Committee agreed to share their manuscript in advance of publication.[35] As stated by NIA Behavioral and Systems Neuroscience Branch Chief Molly Wagster, "those findings from that evaluation study were used in part to launch, or justify, or create sort of an impetus for the Healthy Brain Initiative."[36] In the coming together of the Alzheimer's Association's Maintain Your Brain™ program and the NIH's Cognitive and Emotional Health Project, the new Healthy Brain Initiative had two possible bases for its initiative, one focused on behavioral modification claims to consumers and the other based on a new and largely theoretical large-scale research agenda to find ways to preserve the health of the aging American population. CDC's Initiative had to find a place for itself and negotiate a claim of its own somewhere between these consumer-based and research-based efforts.

The Healthy Brain Initiative *Road Map*

Congress agreed to allot funds for "an Alzheimer's specific segment of the Healthy Aging Program" at the Centers for Disease Control and Prevention under its Health Promotion activities in a Congressional budget Conference Agreement on November 19, 2004.[37] Shortly afterwards at a Healthy Aging Program press event for the release of its report *The State of Aging and Health in America*[38]

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[35] Lynda Anderson, interview by author, Atlanta, GA, August 31, 2010.

[36] Molly Wagster, interview by author, Bethesda, MD, August 22, 2011. Lynda Anderson concurred, interview by author, Atlanta, GA, November 21, 2011.

[37] The budget for the fiscal year ending September 30, 2005 (Public Law 108-447) was passed December 8, 2004, reflecting the Conference Agreement on House Resolution 4818 Consolidated Appropriations Act, 2005, passed November 19, 2004. See p. 1160.

[38] Merck Company Foundation and Centers for Disease Control and Prevention, *The State of Aging and Health in America 2004*. (Washington, DC: Merck Institute of Aging & Health, 2004).

according to Lynda Anderson, McConnell unexpectedly announced the grant of $1.6 million to CDC for the establishment of an "Alzheimer's specific segment."[39]

The Healthy Aging Program immediately set up a series of meetings between the two organizations in Washington to discuss the vision for the program. The meetings, Anderson said,

> ...gave me sort of a pre-warning, in some ways, because what I didn't want to have was a disease component to the Healthy Aging Program, and that was what it was being thought about as – as Alzheimer's disease and having this "segment." And before I got there [to CDC's former Healthcare in Aging branch, now the Healthy Aging Program], there was a bit of concern about introducing a disease to a program that had been very cross-cutting, you know, concerning emerging issues in public health. So we did a lot of strategic thinking about how we could fit a "disease segment" within that. We first started thinking about terms like "brain health" .... and laid out a plan really to say to the Alzheimer's Association, well as the CDC we're a science-based organization, so we really need to have a series of steps to say, what's the current state of the science, where would public health's role or its niche be within that, and then how would the Healthy Aging Program's goals align with that....[40]

Anderson's words describe more than a challenge in sorting out the concepts of health, disease, and aging. They suggest that Anderson was not happy with the data supporting the argument to invest in Alzheimer's at HAP in order to, as the legislation said, "aggressively educate the public and health professionals as to ways to reduce the risks of developing Alzheimer's by maintaining a healthy lifestyle."

HAP invited a representative from the Alzheimer's Association to visit their offices in Atlanta and present the Maintain Your Brain™ workshop that had been disseminated to the Association's affiliate offices throughout the country

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[39] Lynda Anderson, interview by author, Atlanta, GA, August 31, 2010.
[40] Lynda Anderson, interview by author, Atlanta, GA, November 21, 2011.

and served as a basis for the lobbying for the congressional line item. Anderson characterized Ten Ways to Maintain Your Brain and the evidence presented to back them as a:

> ... kind of stretching, I'll say, of the scientific principles to make them sound like there was much more you could do than we were perhaps comfortable with. Again, these were new partners and we certainly didn't want to be negative about their social marketing campaign, but we did point out it was a social marketing campaign that had a lot of uses to them, but as a scientific campaign we needed to really go and say could we endorse this or would we have other roles ...?[41]

First, Anderson saw the role of the CDC as launching, if anything, a "scientific campaign," as "we're a science-based organization." A scientific campaign would primarily disseminate information on the scientific evidence base that could be turned into action in the public health world. Anderson used the term "social marketing campaign" for Maintain Your Brain™. While "social marketing" appears to be a legitimate role for an advocacy organization, she suggested it was not appropriate for a science organization without the establishment of an adequate evidence base first.

The Alzheimer's Association had been exposed to resistance from its own scientific advisors. For example, Association Board Member Peter Rabins was concerned

> that to put a huge effort into an advertising campaign focused on healthy brain aging before it was clear that we knew anything about it was a mistake, was a scientific mistake and in some ways also a mistake in the sense that it was moving the efforts of the organization away from the disease around which it was formed and the people affected by that disease, its main constituency, by trying to significantly broaden that constituency to normal aging and healthy aging, that it either

[41] Lynda Anderson, interview by author, Atlanta, GA, August 31, 2010.

> might be perceived or actually undermine efforts to support people who have the disease, and I think myself that that partly happened[42]

Dr. Rabins' assessment that Maintain Your Brain™ was launched "before it was clear we knew anything about" healthy brain aging suggests that the ideas were ready for public health research, not dissemination. Throughout the meetings that followed, the CDC voiced its views, and the Maintain Your Brain™ campaign was soon discontinued. One of the reasons for the discontinuation given by McConnell was the arrival in 2005 of a new president and CEO Harry Johns who wanted to reverse course. Thus from the very beginning of the Healthy Brain Initiative the new cognitive health perspective at the Association was on slightly shaky ground.

Given that this was a new initiative for CDC's Healthy Aging Program, an independent contractor, Bearing Point Group, was hired to help facilitate an initial meeting, in partnership with the Alzheimer's Association, to understand the current state of the science on risk factor reduction and cognition. The partnership also formed a Steering Committee, which was co-chaired by Lynda Anderson and Steve McConnell and included members from the National Institute on Aging, the Administration on Aging, non-profit organizations, academia, and state public health departments.

Building on the work of the CEHP, a group of national experts were gathered by the Steering Committee to guide the initial phases of The Healthy Brain Initiative. It convened a public health research meeting called *The Healthy Brain and our Aging Population: Translating Science to Public Health Practice*,

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[42] Peter Rabins, interview by author, Baltimore, MD, August 11, 2011.

an intensive two-day meeting in May 2006 at which invited participants examined public health research and provided professional opinions about addressing risk and protective factors for promoting cognitive health.

The research meeting consisted of three moderated sessions on 1) Cardiovascular risk factors and maintenance of cognition, 2) Physical activity and maintenance of cognition, and 3) Translating science into public health practice. Deciding areas of focus, according to William Thies, "was quite easy because ...in terms of the number and strength of studies that we do have, it's pretty clear that physical activity layers out on top, cardiovascular risk factors layers out second as a group.... And then *a very distant third* is cognitive stimulation."[43] The focus areas were also areas that the CDC had previously endorsed in other contexts. Eight speakers were invited to speak to an audience of about 60 research scientists. The meeting examined associations between blood pressure, cholesterol, diabetes, weight, smoking, and physical activity level and cognitive health and reported "substantial evidence" for the association between cardiovascular health and cognitive health as well as between cumulative risks for vascular disease and increased risk for stroke and cognitive decline. By meeting's end "the scientists ... agreed that existing research provides a good basis for developing a national public health roadmap that could lead to interventions to promote and protect brain health."[44] Subsequently, the meeting's presentations

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[43] Bill Thies, interview by author, Chicago, IL, December 5, 2011.

[44] Marilyn S. Albert, David R. Brown, David Buchner, James Laditka, Lenore J. Launer, Paul Scherr, William Thies, Molly V. Wagster, "The Healthy Brain and Our Aging Population: Translating Science to Public Health Practice," *Alzheimer's & Dementia* 3, no. 2 Supplement (April 2007): S4.

and conclusions were turned into a special publication of *Alzheimer's and Dementia*.[45]

Following this review, the Steering Committee provided oversight for the creation of *The Healthy Brain Initiative: A National Public Health Road Map to Maintaining Cognitive Health* (*The Road Map*), a document intended to provide a framework to guide a coordinated public health response across many different agencies and organizations to address cognitive health. This document was introduced in Chapter 1.

From the start, the Healthy Brain Initiative saw its role as gathering and managing several large bodies of professionals together to include multiple perspectives in the shaping of the *Road Map*. The Planning Committee not only organized the initial scientific meeting but also worked out a conceptual model that ostensibly marks a place both for the CEHP call to "map a future research agenda" and the Alzheimer's Association's (Maintain Your Brain) argument that the public can benefit from a healthy brain behavior messaging. Stating that "We envision a nation in which the public embraces cognitive health as a priority and invests in related health promotion and research," they used a "synergistic push-pull" model for "moving science into health practice."[46] The model depicts an upside down triangle of forces that lead to intermediate and long-term goals, as shown in Figure 4.2 below:

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[45] *Alzheimers & Association* Volume 3, no. 2 Supp (April 2007).
[46] CDC & AA, *Road Map*, 24.

Fig. 4.2. The conceptual model for the Healthy Brain Initiative

On the top left side is the "push" of science towards the public: "*existing science and knowledge base* for preserving and protecting cognitive health." On the upper right side is the "pull" of the market or the need for information: "*social and environmental forces* that create demand and influence the acceptance of new knowledge." Although presumably sometimes imbalanced, with demand sometimes pulling too much on the science and science sometimes pushing information that cannot yet be translated for public use, these two forces

are depicted as working "synergistically" to bring science into practice. At the bottom of the triangle below are the Capacity entities that balance and facilitate the movement, including the CDC. They "build and strengthen capacity," the resources, partnerships, and competencies that can implement public health interventions. Capacity building then leads to intermediate outcomes (fourteen outcomes relating to knowledge and aware about population-level cognitive health) and the ultimate long range outcome, "to maintain or improve the cognitive performance of all adults."[47]

The Steering Committee identified professionals from across the country, calling on them to form four work groups on the topics of Prevention Research, Surveillance, Policy, and Communication. Each group was staffed with professionals possessing either specific cognitive expertise or generic methodological expertise within the relevant area. The Surveillance Work Group, for example, included professionals with expertise in cognitive performance assessment (for example Hugh Hendrie) as well as those with expertise in general public health surveillance. Up to 20 professionals comprised each group. The groups were given the following "prompt" to use to generate ideas: "develop a set of recommended actions for moving the nation forward over the next 3 to 5 years toward the long-term goals of maintaining and improving the cognitive function of adults." Each group negotiated a conceptual framework of its own and then generated action items collectively over a period of 3 months over email and phone. Their action items were pooled by the steering committee and given to two other advisory groups for rating and sorting anonymously online. A first

[47] Ibid.

group of 21 people sorted action items into categories. The second larger group of 141 people rated the items in terms of 1) importance and 2) feasibility. At this stage the consultant Concept Systems, Inc. took over and generated hierarchical cluster maps and other representations synthesizing the individual responses. One of the most useful formats was a grid cross-tabbing importance ratings with feasibility ratings. A "go-zone" with the items most highly rated for importance and feasibility was used for each category to determine the top ten priorities of the Road Map.[48] In total, the process took 18 months and generated 44 suggested action items and ten immediate priorities.

The process reached a large number of people across many fields, from representatives at NIH who were running large clinical trials and academic researchers, to people from state public health departments, to representatives from the Administration on Aging and other federal agencies, to physicians involved in dementia care, and the Alzheimer's Association advocates, among others. It assembled groups and required communication among professionals who in some cases had rarely encountered each other. In this sense the *Road Map* development process was a public health intervention among policymakers to bring many different stakeholders into the process and commit them to the product. As Lynda Anderson stated, "we really did want to develop a road map that everybody could see themselves in."[49]

As a self-proclaimed *Road Map*, the HBI text can be thought of as an argument for where we should be going as a nation in terms of cognitive health.

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[48] For a full discussion of the process, see Anderson et al., "Using a Concept Map as a Tool for Strategic Planning."

[49] Lynda Anderson, interview by author, Atlanta, GA, November 21, 2011.

In the section subtitled "Why is it important – and why now?" the authors state that "Given the tremendous burdens described, their impact, and the developing science, public health should step forward to address cognitive health. The potential contributions to quality of life, the positive impact on caregivers, and the anticipated savings in the costs of health care and other services would be considerable."

The main argument in the *Road Map* is, as stated in Chapter 1, that *public health should step forward to address cognitive health*.[50] Supporting this claim are two lines of evidence that can easily be mapped to the Push-Pull model. On the push side, is "the developing science." On the Pull side is public demand and motivation: "[T]here are emerging signs that Americans look to the future with hope. Based on several surveys, men and women in this country are willing to take important steps to improve their cognitive health." The warrant linking this data to the claim is that it is an ideal moment for public health to seize to make a difference. The implied backing is the growing prevalence and costs of cognitive decline in the U.S.[51]

Public health should "step forward to address cognitive health" in the ways outlined in the document, including ten immediate "priorities for action." These are:

> [1] Determine how diverse audiences think about cognitive health and its associations with lifestyle factors.
> [2] Disseminate the latest science to increase public understanding of cognitive health and to dispel common misconceptions.

[50] CDC & AA, *Road Map*, 15.
[51] CDC & AA, *Road Map*, 12-14.

[3] Help people understand the connection between risk and protective factors and cognitive health.
[4] Conduct systematic literature reviews on proposed risk factors (vascular risk and physical inactivity) and related interventions for relationships with cognitive health, harms, gaps and effectiveness.
[5] Conduct controlled clinical trials to determine the effect of reducing vascular risk factors on lowering the risk of cognitive decline and improving cognitive function.
[6] Conduct controlled clinical trials to determine the effect of physical activity on reducing the risk of cognitive decline and improving cognitive function.
[7] Conduct research on other areas potentially affecting cognitive health such as nutrition, mental activity, and social engagement.
[8] Develop a population-based surveillance system with longitudinal follow-up that is dedicated to measuring the public health burden of cognitive impairment in the United States.
[9] Initiate policy changes at the federal, state, and local levels to promote cognitive health by engaging public officials.
[10] Include cognitive health in Healthy People 2020, a set of health objectives for the nation that will serve as the foundation for state and community public health plans.[52]

In terms of a policy argument, then, the *Road Map* suggests that public health needs to provide public health information on modifiable lifestyle behaviors that can affect cognitive health in the form of evidence-based interventions. It needs to do this by talking to and surveying the public about their needs, expectations, and motivations, by researching promising interventions at the community level for their effectiveness and moving successful interventions into community practice, and by communicating the cognitive health priority to public health officials. Not chosen as priorities were action items in the action clusters of "Developing capacity" (e.g. "Engage the

[52] CDC & AA, *Road Map*, 2.

private sector and other entities in planning and funding research to address ways to maintain and improve cognitive health, including clinical trials" and "Convene researchers and community interventionists conducting interventions on risk and protective factors to identify potential mechanisms to advance the work in the field of cognitive health") and "Measuring cognitive impairment and burden" (e.g., "Identify measures of the public health burden of cognitive impairment on individual people, families, and communities").[53]

Despite the ten recommended priority actions specified, the *Road Map* remains mystifying on the level of where all these separate actions are headed. Missing from the document is a clear vision of cognitive health as distinct from dementia, cognitive impairment, and age-related cognitive decline. It is also not clear that the recommended actions will ever get the participants to that place of understanding. If the "lofty" goal is "To maintain or improve the cognitive performance of all adults," what does that goal look like?

Road Map **Visuals**

The document, it can be argued, offers an answer in explicit visual terms. The 44 actions "to achieve this goal" are aimed at a professional public health readership. However, the photos included in the document are of ordinary folk and therefore appear to provide an image of the type of cognitive performance sought. The *Road Map* is a beautifully designed 8" square document, comfortable to hold and leaf through, with warm yellow and purple pages and some 44 black-and-white photographs of various sizes featuring people of many

[53] CDC & AA, *Road Map*, 50-51.

races between the ages of roughly 50 and 80 years. As the primary visual focus of each page spread, the photographs leap out at the reader and convey a consistent and uniform picture of happiness. It is through these visuals that the document seems to make its case for the cognitive health goal it is advocating. Yet by looking at the visuals alone, no one would ever guess that the document's context is cognitive health.

Most of the photos in the *Road Map* depict good looking and healthy middle-aged adults who are happily engaged in outdoor activities. Presumably they show cognitively well functioning adults who want to maintain this status as they age. In the context of a "national public health road map to maintaining cognitive health," the photos seem to add up to a visual portrait of the cognitively healthy population of older adults that we are seeking to create. As representations of real people engaged in real activities, these photographs are themselves evidence for older adults' ability to engage in the activities shown – smiling, laughing, making love, being in extended families, running on the beach and on the track, swimming, playing tennis, surfing, going fishing and boating and kayaking, hiking, singing, dancing, gardening, hoola-hooping, and romping like children (see Figure 4.3, photo on left).[54] Collectively the photos suggest that this goal is desirable, realistic, and feasible. A warrant for this argument might be that each of the activities and emotions shown in the photos requires cognitive health, therefore a populace with these qualities would demonstrate the "lofty goal" of maintaining or improving the cognitive performance of all adults. Backing the warrant could be the definition given by the experts within the HBI,

[54] This is an inclusive list of photographs appearing throughout the pages of the *Road Map*.

that healthy cognitive functioning includes "language, thought, memory, executive judgment (the ability to plan and carry out tasks), attention, perception, remembered skills (such as driving), ability to live a purposeful life."[55]

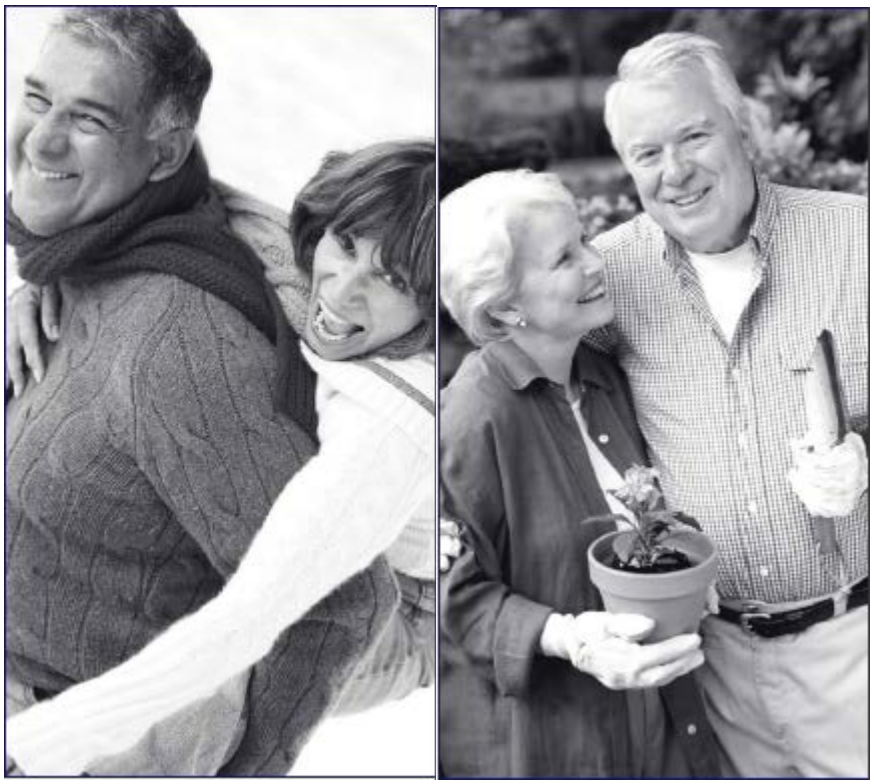

Fig. 4.3 Photos from CDC and AA, *Road Map*, 15, 9

Does the argument work? I am not convinced. One of the sample activities shown in several photos is of a couple gardening (See figure 4.3, photo on right). Presumably gardening involves getting dressed appropriately for the activity in gloves, boots, and hat (an executive judgment), planning where to plant flowers (an executive judgment), describing which plants go where to one's partner and resolving differences (language), noticing weeds and thirsty soil

[55] CDC & AA, *Road Map*, 6. Although there is a definition of cognitive health, it remains an list of abstract items without context or measure.

(perception), remembering that a certain plant needs pruning after it has bloomed (memory), using tools such as trowels, rakes, and mowers (remembered skills), and taking conscious pleasure in the undertaking (ability to live a purposeful life).

If the photos depict healthy cognitive functioning, the representations must not show cognitively impaired people. Yet someone who is cognitively impaired might still be able to garden through other means besides their own cognition. There is a program at Emory University Wesley Woods (Horticultural Therapy Program) that involves facilitating gardening for people with dementia to provide physical activity, social engagement, tactile pleasure, purpose (planting life), and so forth. With social support, the man or woman depicted as a couple might do just fine, cognitively impaired or not. They may not be maintaining cognitive performance but rather compensating for cognitive impairment. In contrast, it would be impossible to imagine a demented person reading a book or playing chess, and although many people would consider these activities to indicate cognitive health, they are not depicted.

The level of cognition depicted appears to be out of sync with the few widely accepted performance measures that we have in place. The level shows social companionship and outdoor activity, suggesting at least competence in the Activities of Daily Living performance measures (e.g., ambulation, toileting, feeding, dressing, and personal hygiene). However, it does not encompass any of the higher-level Instrumental Activities of Daily Living (IADL) that are more cognitively demanding, such as using transportation, taking one's medications,

managing finances, using the telephone, shopping (handling money).[56] Housework is an IADL that might be analogous to gardening because it involves steps and general improvement of one's environment and there is no specific product at the end of the process. The IADLs are widely accepted among researchers, caregivers, and policymakers alike. The photos in the *Road Map* are almost all out of sync with that scale. Instead of necessary daily activities, their subjects are engaged in leisure pursuits. While some people might enjoy and be able to afford kayaking, all people need to be able to count money in order to shop and to protect themselves from exploitation. The consequences of poor cognitive health do not have to be as dire as Reverend Brown's social death to be very serious. They may even include lack of confidence because of a perceived or feared inability to count change. There is something in between total health and full dementia, and to depict the middle ground is to grapple with some of the most compelling issues of cognitive aging.

The norm depicted in these photos is of outdoors-loving and sporty heterosexual couple hood, far removed from the hassles of everyday life. The photographs are predominantly shot in outdoor settings (39 vs. 5 indoor). They depict people who are in heterosexual couples (26 vs. 1 in a same-sex couple, 8 in other groups, and 9 alone). Only four of the photos showed women alone, which is overwhelming the state of elder adulthood. About half of the photos (20) showed sports paraphernalia. While many of the photos are contemplative (showing couples touching and staring into the distance, for example), only one

[56] M. Powell Lawton and Elaine M. Brody, "Assessment of Older People: Self-Maintaining and Instrumental Activities of Daily Living," *Gerontologist* 9, no. 3 (1969):179-86.

shows someone engaged in a cognitively engaged discipline (meditation or yoga on a mat indoors). Together the photos suggest a kind of happy retirement from stresses of life, the traditional American end of a working life. Most of the people in the photos are baby boomers but they are presumably looking ahead to more of the same as they "maintain" their cognitive performance. However, it is unlikely that this portrayal could fully represent the desired goal of a public health effort to promote cognitive health in older adulthood.

Not only is the visual argument out of touch with daily life, but it is inconsistent with the ways in which American society is changing. We do not see anyone holding down a job in a future where work lives are extended, in an office using a computer or on the telephone; we don't see someone coping with the needs of their everyday lives by themselves, after widowhood, perhaps learning to manage finances for the first time; we don't see them getting accustomed to new social communities in civic centers or retirement communities, striking up conversations, remembering names and introducing new friends. It remains locked in a world of structural lag where life is rigidly structured by age into a sequence of discrete phases: education, work, and leisure.[57]

Together, the argument told through the *Road Map*'s photos seems to be a visual depiction of Rowe & Kahn's controversial vision of successful aging. The people in the photographs do seem to meet the tri-partite definition of having 1) low risk for disease and disability, 2) high physical and cognitive functioning, and 3) active engagement with life. In reality, however, maybe the baby boomers who

[57] Matilda White Riley and John W. Riley, "Structural Lag: Past and Future," in ed. Matilda White Riley, Robert L. Kahn, and Anne Foner, *Age and Structural Lag* (New York: John Wiley & Sons, Inc., 1994): 15-36.

are frightened about losing their cognitive abilities just want and need to hold onto their jobs. The distance between the steps listed in the text of the *Road Map* and the photos depicting the successful aging ideal creates a very abstract and unreal picture for the reader who most likely really wants to understand more about aging and more about cognition rather than see their future projected as a repetition at an earlier stage of life, or an increasingly unlikely possibility of a leisure-based retirement.

Anderson illuminated the intention behind the visuals used in the *Road Map*. Visuals were important to the group, and "we worked for more than a month on getting feedback from stakeholders about how the *Road Map* should appear."[58] The consensus was that the document should be approachable (rather than look like research) because it was trying to reach a broad audience of public health professionals. The images were in the public domain but were selected and placed with the help of the graphic design firm Edelman. As for the content, Anderson wrote that "we wanted images that showed people being physically active as well as 'engaged' in life," perhaps alluding to the Rowe & Kahn model of successful aging. She also stated that the focus on physical activity reflected the epidemiological evidence presented at the HBI's research meeting that being physically active and controlling cardiovascular risk factors promote cognitive health. Anderson's words suggest that she and others saw the photos not as depicting healthy cognitive functioning but as depicting the means for achieving it. According to this reading, the visuals argue that cognitive health *can be maintained* through the following activities: being in a couple, socializing,

[58] Lynda Anderson, e-mail message to author, June 13, 2012.

traveling, jogging, meditating, kissing, gardening, playing tennis, communing with nature, romping, going to the beach, hiking, swimming, socializing with friends and family, playing basketball, doing tai chi, dancing, fishing, boating, hoola-hooping, and romping. This argument leaves the definition of cognitive health to the individual and simply suggests the modifiable behaviors that could achieve it. Evidence is the epistemology presented in broad terms in the text of the *Road Map*. However, this argument would appear to overstate the case because the *Road Map* does not in the end endorse particular modifiable behaviors but instead suggests more research on them before an endorsement can be made. For that reason, the visuals work better as a depiction of successful aging but in either case avoidance of the activity of cognition itself is notable.

Specific Healthy Brain Initiative Projects

In 2005, starting earlier than the *Road Map*, the HAP funded the CDC-affiliated Healthy Aging Research Network (HAN), a CDC-funded network comprised of Prevention Research Centers throughout the U.S., to begin work on a version of the first priority, "Determine how diverse audiences think about cognitive health and its association with lifestyle factors." The topic was extensively researched through 55 focus groups with over 450 participants in nine states in both rural and urban areas across many races and ethnicities (African American, American Indian, Asian, Hispanic, and non-Hispanic White), income levels, and education levels. The discussion questions covered ideas about aging well, terminology for cognitive health terms, motivators for healthful behavior related to brain health, knowledge of brain health and prevention. The

results from this research were reported in a special issue of *The Gerontologist* in 2009.[59]

Engaging the voices of communities assumes that there must be a match between the science findings and community lifestyles in order for interventions to work, that public health officials need to find a point of overlap for the findings to be translated into terms that are understandable, appealing, and ultimately adoptable. One wing of the HAN's formative research conducted 42 focus groups with community-dwelling older adults (mean ages ranging from 60.6 in the Vietnamese groups to 74.4 in the White groups) and quantitatively analyzed answers to the first question of the focus group questionnaire, "Without mentioning a name, please tell us about someone who you think is aging well."[60] As the authors discuss, the question emerged from a critical and probing examination of various definitions of successful aging.[61] Common themes that emerged across all of the groups were that aging well included "living to an advanced age, having good physical health, having a positive mental outlook, being cognitively alert and having a good memory, and being socially involved."[62] Within the area of cognition, all groups except the African Americans and the Vietnamese also mentioned that playing games such as mah-jongg and Scrabble are a sign of aging well. Others mentioned knowing all the names of an extended family, being open to new experiences such as using computers, and

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[59] Sarah B. Laditka, Sara J. Corwin, James N. Laditka, Rui Liu, Winston Tseng, Bei Wu, Renee L. Beard, Joseph R. Sharkey, and Susan L. Ivey, "Attitudes about Aging Well among a Diverse Group of Older Americans: Implications for Promoting Cognitive Health" *The Gerontologist* 49, no. S1 (2009): S30-S39.

[60] Ibid., S30-S39.

[61] Ibid., S30-S31.

[62] Ibid., S38.

communicating with skill are models of aging well.[63] Notable differences among the groups were a statistically significant difference in how poorly Chinese and Vietnamese groups rated their memories in comparison with other groups. Other broad themes across all groups were that the value of continued involvement in volunteer settings, communities, and churches. The authors recommended that values shared across cultures such as community involvement and staying alert could be combined in health communications for promoting cognitive health.[64]

From this work it might be assumed that the next version of the *Road Map* might visually depict the activities suggested by the focus group members as representing healthy cognitive aging – an elder at a family reunion introducing people to each other, giving a wedding toast, playing mah-jongg with friends, exploring an online social network site for older adults, reading a hymnal, or answering phones at a community center. An updated progress report on the HBI published in 2011,[65] however, made no change in its visual argument that healthy cognitive aging is going to beach, mountain biking, jogging, playing baseball with a grandchild, and gardening. Of the 10 photos showing Caucasians, African-Americans Hispanic and Asian people, 6 picture heterosexual couples, 4 picture other groups, and no one is alone. Nine of the 10 are outdoor photos and one setting is ambiguous (could be outdoor or indoor). This time the photos are colored and the sun is shining intensely in all nine outdoor photos. There are no activities pictured indoors, none involving anything remotely intellectual. Although they are often touching, in only one are the subjects even talking to

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[63] Ibid., S35.
[64] Ibid, S38.
[65] CDC, *HBI Progress*.

each other. The focus group research seems not to have influenced the version of successful aging depicted as the continuing goal of the HBI.

Work conducted on the Alzheimer's Association side with HBI funds during these formative years was a community project focusing on the at-risk communities of African American baby boomers in two cities, Atlanta and Los Angeles. This work fell under *Road Map* Priority 2: "Disseminate the latest science to increase public understanding of cognitive health and to dispel common misconceptions." In this project local coordinators at each site ran healthy brain workshops for partner organizations, advocating exercise, diet, and social interaction as "health protective behaviors." The partner organizations then took the information back to their communities. In an evaluation of the program by Macro, it was found that the intervention reached its targeted racial group (African-Americans) but an older group than desired (more seniors than baby boomers). One of the findings of the research was that the term "brain health" presented a possible communication barrier. According to the Associate Director of the Association's Healthy Brain Initiative at the time Felicia Fuller, the barrier may just be a case of a new concept being introduced rather than lack of the right language: "I don't know what other terms we could have used. I think it's a matter of the community getting used to hearing it. At first the idea of a healthy brain/mind was very strange to me, and I was a public health person. But all the time that I was going through public health school no one spoke about the brain or brain health. How is this community going to know about it?"[66]

[66] Felicia Fuller, interview by author, telephone, February 24, 2012.

The formative community research that defined the first projects of the Healthy Brain Initiative were completed by 2009, and more focus began to be directed into a surveillance project that had begun in 2007 and was launched in 2009 when give states agreed to pilot questions on the perceived burden of cognitive impairment on respondents to the Behavioral Risk Factor Surveillance Survey. The HBI also added questions assessing cognitive functioning to the National Health and Nutrition Examination Survey (NHANES).

To Fuller, ending the community-based project was unfortunate and left the communities hanging:

> I don't think it was such a good idea to back out. I hope that the relationships we made were sustained. I wish we could have done more of what we did to educate people, hold two workshops a year for the next two years, but we ended the project and the HBI was transferred to policy in DC. I didn't go. People in the community did comment, Where *are* you? What's going on?[67]

However, the Alzheimer's Association had made a strategic decision to shift the Healthy Brain Initiative from the programming unit in the Chicago headquarters to the Association's policy office in Washington, DC, in November 2009. According to Alzheimer's Association Senior Director of Public Policy Matthew Baumgart,

> there was a significant reason for the shift. In the first four years of the project, from 2005 through the fall of 2009, it was really focused more on building, if I can use the term, building the base, building the framework and the foundation of Alzheimer's as a public health issue, and so the Association really looked at that from a programmatic standpoint. So the two major activities that were undertaken in the first four years were the writing of the *Road Map* and then the second thing was conducting a two-site demonstration project in African-

[67] Ibid.

> American communities in Atlanta and Los Angeles. In the fall of 2009, as we entered the fifth year of the five-year cooperative agreement, we at the Association decided that we needed, and what we were going to push for in reapplying for a second five years was to shift the focus, because the groundwork had been laid, that we really needed to (this is not my phrase, I'm borrowing the phrase from somebody else in the Association), it needed to be a more "influencers'-oriented" project. That is, we've put out the framework, the *Road Map*, we've laid the groundwork, we've done a demo project, we really now need to start spreading the word, so to speak, talking amongst ourselves, that Alzheimer's is a public health issue, is not going to reach those who actually make Alzheimer's a public health issue and do something about it.[68]

In Baumgart's words the entire focus of the ongoing project had been and would continue to be "Alzheimer's disease." While the Initiative came from the Alzheimer's Association, it also came out of a new perspective of "maintaining" the brain and it endorsed the language of health promotion in the *Road Map* document. However, the argument that there are different outcomes in aging than Alzheimer's disease, or absence of Alzheimer's disease, seems to have been lost.

Largely through the efforts of the Alzheimer's Association, the Healthy Brain Initiative achieved another one of its action items, successfully lobbying for a new topic area to incorporated into *Healthy People 2020*: "Dementias, including Alzheimer's disease," with two separate objectives, 1) "To increase the proportion of persons with diagnosed Alzheimer's disease and other dementias, or their caregivers, who are aware of the diagnosis...." and 2) "To reduce the proportion of preventable hospitalizations in adults with diagnosed Alzheimer's

[68] Matthew Baumgart, interview by author, telephone, December 2, 2011.

disease and other dementias...."[69] The effort added cognitive health to this once-in-a-decade health promotion agenda for the first time, although it framed in terms of disease.

One of the reasons for the drop in status of the cognitive health thrust, which was to have been a major focus of the Association, was explained by McConnell not as pushback from the CDC or scientific advisors but push-back from the traditional constituency of the Association:

> Family pushed back *very* strongly. Because, you know, think about it: If Alzheimer's disease is preventable, the flip side of that is that people are getting it because they're doing something wrong. And the families who are suffering under this God-awful disease were really unhappy with that portrayal. Now, you know, that wasn't how the Alzheimer's Association was portraying it, but it came across to them as being 'blame the victim'.[70]

From McConnell's description, the pushback from scientists who doubted the lifestyle behavior recommendations for scientific reasons was compounded by the pushback from the Association's traditional constituency who had not considered the disease to be modifiable. To McConnell it "was a noble cause, and again it was based on the science, but I think there was a sense that it just didn't work for the Alzheimer's Association." McConnell's point is a very important one because it raises the issue that perhaps one of stumbling blocks of the public health efforts for cognitive health was the historical and political baggage of the very organization that spearheaded it. It suggests that the Alzheimer's Association may not be the best champion for the cognitive health cause.

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[69] CDC, *HBI Progress*.
[70] Stephen McConnell, interview by author, telephone, September 14, 2011.

As the CDC and the Alzheimer's Association moved towards the end of one 5-year cooperative agreement to the start of another, there was an uncertainty about where they would go next. There was hope that the National Institutes of Health State-of-the-Science Conference on Preventing Alzheimer's Disease and Cognitive Decline in April 2010 would shed light on the evidence available for use in public health to promote cognitive health.

Closing Argument: The State-of-the-Science Conference Statement

The State-of-the-Science Conference asked one question that was directly relevant to the Healthy Brain Initiative: Question 4 "*What are the therapeutic and adverse effects of interventions to improve or maintain cognitive ability or function?*" The inclusion of "improving or maintaining function" seems to depart from the purpose of the conference as titled, "Preventing Alzheimer's disease and cognitive decline." However, there is consistent slippage between use of the terms "maintenance" and "prevention" in the answer to this question, seemingly incorporating "improving or maintaining function," into the disease framework rather than entertaining the possibility that it is a very different concept and trajectory, needing its own kind of evidence.

The Evidence Report presented to the Panel for consideration states that RCTs were prioritized as evidence in answer to Question 4, that the outcome of consideration for Question 4 was "Diagnosis of mild cognitive impairment using an acceptable standard (e.g., Petersen's criteria) or change in cognition using at least two measurements on an acceptable measure," and that the follow-up period for interventions had to be at least two years after the initial exposure or

intervention (versus one year for AD outcomes).[71] The first line of the findings on Question 4 states that "Several interventions have been evaluated with respect to improving cognitive function or preventing cognitive decline. Despite some encouraging associations found in observational studies, RCTs of specific interventions have not definitively established positive therapeutic effects on maintaining or improving cognitive function, or preventing cognitive decline."[72] The first line establishes intervention as the distinct focus of this section – as opposed to clinical work or basic science – and could be very applicable to public health.

Reasons given for the lack of definitive conclusions are "(1) lack of a validated and consistent definition of cognitive decline; (2) the small number of RCTs with cognitive decline as a primary outcome; (3) limitations of study design and analysis...." If the question truly concerns the maintenance and improvement of cognitive ability or function, it is striking that the authors do not cite the lack of a validated and consistent definition of "cognitive maintenance or improvement" and the small number of RCTs with "cognitive maintenance or improvement" as the outcome.

The answer to the question cites four areas of intervention that were assessed. The first section, "Vitamins, Nutrients, and Dietary Supplements," immediately summarizes the panel's finding that "several RCTs did not find a role of vitamin supplementation in preventing cognitive decline." Subsequently sentences variously used the phrases "did not improve or maintain cognitive

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[71] Duke Evidence-based Practice Center, *Evidence Report/Technology Assessment No. 193*, 18-20.

[72] Daviglus et al., *State-of-the-Science Conference Statement*, 14.

function in elderly persons" and "found no effect on cognitive functioning." The second section, "Medications," uses the terms "no cognitive benefit," no "preventive effects on cognitive decline," "may worsen cognitive outcome," and "no consistently positive effects on cognitive decline," and "Together, these data suggest that no currently available medications can prevent the onset of cognitive decline." The third section, "Cognitive engagement," was most promising and was structured around the ACTIVE trial:

> A large randomized trial of cognitive training (consisting of memory, reasoning, and speed) over 5 to 6 weeks with a subsequent booster period showed modest benefits on cognitive functioning and a small, statistically significant effect on reducing the extent of age-related cognitive decline at 5-year follow-up. This trial also showed a very small statistically significant benefit on instrumental activities of daily living – for example, managing finances, managing medications, and keeping house – and, in a subgroup analysis, benefit on driving performance in elderly persons. However, these findings need to be replicated to confirm the benefits of cognitive engagement on preventing cognitive decline over a longer period and in persons with varying levels of baseline cognitive abilities before firm recommendations can be made. The sustainability of these behaviors must also be assessed in large, community-based samples, in which other, less rigorous interventions showed no benefit.[73]

The fourth section, "Physical activity" reported that "the data were insufficient to state that aerobic activity improves or maintains cognitive function....Work is ongoing to further investigate the benefits of physical activity."

Stepping back from the specific findings, the statement presents the argument that the panel cannot recommend behavior change of any kind in support of cognitive health. It supports this claim with data from randomized controlled trials of specific interventions. The warrant for why the data answers

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[73] Daviglus et al., *State-of-the-Science Conference Statement,* 15-16.

the question is that RCTs are the required proof of effect. The backing for this warrant is the whole field of evidence-based medicine. It is interesting that the bar was further raised to require that cognitive engagement trials be "sustainable" or adhered to, a whole other topic of consideration.

As previously described, the reaction to the conference statement was heated, but in the policy world it was a definitive statement that there were no modifiable lifestyle behaviors that could be promoted for cognitive health in an older population. The HBI ceased "to pursue this whole thing of lifestyle interventions."[74] In support of the State-of-the-Science Conference statement, Anderson referenced a subsequent systematic review conducted by the HAN that also concluded that studies were not sufficient to recommend physical activity interventions to communities. She asserts that "by doing these systematic reviews we could see where there were actually weaknesses in the studies that could be changed to then have those studies have a better chance of being used by the public health community."[75] The intervention studies available for analysis tested interventions that were far below the government's recommended physical activity levels and didn't sustain them for long enough, and "You can't keep doing the *same studies*" which show no effect. The type of studies that are needed, according to Anderson, are physical activity programs that measure cognition in community settings, for example "go out to a senior center, do a physical activity program, and then measure cognition."

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[74] Lynda Anderson, interview by author, Atlanta, GA, August 31, 2010.
[75] Ibid.

The argument that the government should invest in brain health, the same argument that the Alzheimer's Association brought to Congress for its original line item, no longer works, according to the Association's Bill Thies. The "emerging evidence" on the promising lifestyle behaviors and overlap between one disease and another has been superseded by a higher standard, one that researchers may not be able to reach for reasons beyond their control – lack of time to conduct decades-long interventions, lack of funds to support them, the ethical impossibility of suppressing healthful behaviors in a control group.

Baumgart recounts a colleague's parody of the types of trials the State-of-the-Science conference was asking for:

> there's no randomized controlled clinical trial that says if you rip out my spleen I will die, and yet I know if you come in and rip out my spleen I'm going to die. But the NIH standard was such that they wouldn't say, if you rip out a person's spleen they'll die because there's never been a randomized controlled clinical trial about people ripping out spleens.[76]

Felicia Fuller too echoed these sentiments more directly: "I walked out of that conference feeling sick. It didn't say anything. We see the connection between vascular factors and brain health. But they said the evidence was not strong enough to do anything. The RCTs are so hard to do. Also where's the money going to come from?"[77] Thies went so far as to suggest that it might have been better had the conference never been held.[78]

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[76] Matthew Baumgart, interview by author, telephone, December 2, 2011.
[77] Felicia Fuller, interview by author, telephone, February 24, 2012.
[78] Bill Thies, interview by author, Chicago, IL, December 5, 2011.

In rebuttal to the Conference Statement, Association representatives indicate that the definitive findings of the MRFIT Study,[79] forty years in the making, that lack of physical activity is a risk factor for heart disease can be used to spread messages about the value of physical activity for brain health. Says Thies,

> ...as far as I'm concerned, including increased physical activity in anybody's life does so many good things and it may help your dementia, so as an effort for the Association I think it's a perfectly reasonable thing for us to do. *It can't do any harm*. It's perfectly clear that increasing physical activity has a public health benefit, and so when you look at that it's reasonable for us to take a sufficient chance to be one of the people who's adding a public health benefit to the community with increased physical activity as a piece of advice and maybe it will reduce dementia.

Thies raises the *Opportunity Cost Argument* for brain health promotion and offers a challenge to the NIH at the top of the research infrastructure in the U.S. and perhaps also to the CDC.

The Alzheimer's Association's *2010 Annual Report* announces new five-year cooperative agreement with CDC through 2015, however, makes it clear that the Association has shifted to risk surveillance:

> Formally known as the Healthy Brain Initiative, the new agreement will continue to advance Alzheimer's as a public health issue and examine possible means of risk reduction. Through the Healthy Brain Initiative, the Association secured 18 states' use of the Cognitive Impairment surveillance module in 2011. This is part of an annual health surveillance survey conducted in all 50 states. This will provide the Association, federal and state government agencies and others with unprecedented information on the prevalence and incidence of cognitive impairment.[80]

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[79] Multiple Risk Factor Intervention Trial Research Group, "Multiple risk factor intervention trial. Risk factor changes and mortality results," *JAMA* 248, no. 12 (1982): 1465-77.

[80] Alzheimer's Association, *2010 Annual Report* (Chicago: Alzheimer's Association), 10.

Much of the success of the effort, it seems, was in facilitating an interdisciplinary dialogue. In Dr. Rabins words, the Alzheimer's Association "brought the CDC and what I would call the prevention infrastructure into this conversation" about primary prevention. CDC asked its Healthy Aging Research Network to engage with the topic of cognitive health for the first time. According to Anderson, the Alzheimer's Association indicated that it was engaging with public health science by hiring an epidemiologist for the first time. Mike Splaine described the contribution that the project made in the public health world: "[T]he dissemination process built around the *Road Map* initiative started to get public health realizing that it's not all smoking, fat people, and STDs, that in fact there's another public health concern."[81] Splaine depicted a learning curve on the part of the Association and the shift to surveillance work: "How does public health work? If you count it, they're going to do something about it...If public health counts it, they've got to do something about it. Simple strategy."

"The Age of Alzheimer's"

On October 27, 2010, six months after the NIH State-of-the-Science Conference, the *New York Times* published an op-ed piece "The Age of Alzheimer's" written by former Supreme Court Justice Sandra Day O'Connor, Nobel Prize winning neurologist and biochemist Stanley Prusiner, and President and CEO of the baby boomer marketing firm AgeWave Ken Dychtwald that called for $2 billion in funding for Alzheimer's disease drug research. The text is quoted below:

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[81] Mike Splaine, interview by author, telephone, November 28, 2011.

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(see http://www.nytimes.com/2010/10/28/opinion/28oconnor.html) [82]

[82] Sandra Day O'Connor, Stanley Prusiner, and Ken Dychtwald, "The Age of Alzheimer's," *New York Times*, October 28, 2010: A.33.

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The claim made by the editorial was that the *U.S. government needs to invest in research to develop "new medicines that attack the causes of the disease [Alzheimer's] directly*." More specifically, they need to "find out how the aberrant proteins associated with the disease develop in the brain. They need to model the progression of the illness so they can pinpoint drug targets. And ultimately they must learn how to get drugs to move safely from the blood into the brain." The data to support this claim is the negative evidence that lifestyle behavior modification do not work: "Experience has taught us that we cannot avoid Alzheimer's disease by having regular medical checkups, by being involved in nourishing relationships or by going to the gym or filling in crossword puzzles." While the State-of-the-Science Conference Statement is not cited, its findings are implied. In addition the authors add in the weak anecdotal evidence that Ronald Reagan engaged in healthy behaviors (cognitive engagement, physical fitness) and had social support and he still got Alzheimer's. Because lifestyle behavior approaches have failed, drug development is the model we need to follow, and currently Alzheimer's disease is "an illness that is 100 percent incurable." The editorial does not point to past failed drug trials. The warrant linking inadequate lifestyle modification research with the need for more biomedical funding seems to be simply that basic biomedical science and pharmaceutical interventions are more legitimate than behavioral science findings and interventions. The warrant is backed by the example of AIDS

research, which received a huge influx of funds in the mid-1980s and had a subsequent breakthrough discovery of antiretroviral drugs.

As asserted by the editorial, Alzheimer's not cognitive health should be the focus of our national efforts. The authors call for a "well-financed national strategic plan." They urged support for the National Alzheimer's Project Act then before Congress. Ms. O'Connor had served on the Alzheimer's Study Group chaired by Newt Gingrich and Bob Kerry that advocated for a similar investment, a document that was formally endorsed by Dr. Prusiner.[83] Among other suggestions, their report recommended to "Extend market exclusivity for Alzheimer's disease therapies" as an "incentive to the biopharmaceutical industry to increase investment in Alzheimer's drug development." Beyond backing a pharmaceutical development agenda that many healthy brain advocates have called defunct, the group notably makes no similar recommendations for continuing to research promising low-cost lifestyle therapies as described by healthy brain proponents.[84]

The National Alzheimer's Project Act

In the wake of the State-of-the-Science Conference and the few years of activities in the Healthy Brain Initiative, Anderson was asked about the future of the HBI. She responded, "HHS [the Department of Health and Human Services] is taking over. They're doing a strategic plan through NAPA. The National

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[83] Newt Gingrich, Bob Kerrey, Christine Cassel, Meryl Comer, Steven E. Hyman, Henry McCance, Mark McClellan, Sandra Day O'Connor, James Runde, David Satcher, Harold Varmus, Robert Egge, "A National Alzheimer's Strategic Plan: The Report of the Alzheimer's Study Group," http://www.alz.org/documents/national/report_asg_alzplan.pdf (accessed November 9, 2012).

[84] Ibid., 28.

Alzheimer's Project Act is, specifically in terms of language, going to come up with a national strategic plan about Alzheimer's disease."[85] Given earlier comments that "what I didn't want to have was a disease component to the Healthy Aging Program, and that was what it was being thought about as – as Alzheimer's disease and having this 'segment'" this statement suggests a shift in orientation away from cognitive health promotion.

On January 4, 2011, President Barrack Obama signed the National Alzheimer's Project Act (Public Law 111-375) into law. The official summary of NAPA is as follows:

> National Alzheimer's Project Act -
> Section 2 -
>
> Establishes in the Office of the Secretary of Health and Human Services (HHS) the National Alzheimer's Project. Requires the Secretary to: (1) be responsible for the creation and maintenance of an integrated national plan to overcome Alzheimer's; (2) provide information and coordination of Alzheimer's research and services across all federal agencies; (3) accelerate the development of treatments that would prevent, halt, or reverse the course of Alzheimer's; (4) improve the early diagnosis of Alzheimer's disease and coordination of the care and treatment of citizens with Alzheimer's; (5) ensure the inclusion of ethnic and racial populations at higher risk for Alzheimer's, or least likely to receive care for Alzheimer's, in clinical, research, and service efforts with the purpose of decreasing health disparities in Alzheimer's; and (6) coordinate with international bodies to integrate and inform the fight against Alzheimer's globally.
>
> Directs the Secretary to: (1) use discretionary authority to evaluate all federal programs around Alzheimer's, including budget requests and approvals; and (2) annually assess the nation's progress in preparing for the escalating burden of Alzheimer's. Establishes an Advisory Council on Alzheimer's Research, Care, and Services to advise the Secretary and provide the Secretary and Congress with: (1) an initial evaluation of all federally-funded efforts in Alzheimer's research, clinical care, and institutional-, home-, and community-based programs and their

[85] Lynda Anderson, Interview by author, Atlanta, GA, November 21, 2011.

> outcomes; (2) initial recommendations for priority actions to expand, eliminate, coordinate, or condense programs based on their performance, mission, and purpose; (3) initial recommendations to improve health outcomes and reduce the financial impact of Alzheimer's on Medicare and other federally-funded programs and on families living with Alzheimer's disease; and (4) an annual evaluation of the implementation and outcomes of the recommendations through an updated national plan. Terminates the Advisory Council on December 31, 2025. Directs federal agencies to share Alzheimer's data with the Secretary. Sets forth reporting requirements. Terminates the Project on December 31, 2025.[86]

The focus on Alzheimer's disease diagnosis and treatment would seem to be at odds with a public health initiative aimed at promoting health in older adults. In the public health world, treatment ideally comes last, after the long line of prevention opportunities has been exhausted, when disease itself can no longer be avoided. The document includes one mention of "cognitive health," which appears in reference to a task for CDC to "Work with state and local health departments to identify public health contributions to cognitive health" by June 2013 in order to "Strengthen the state aging and public health workforces."[87] There are no references to "brain health" or "healthy cognition" or "brain functioning." The transfer, however slight, from the Healthy Brain Initiative that tried not to reference disease and to promote cognitive health to a national plan to treat and cure Alzheimer's suggests a powerful disease-based paradigm in the United States that is entrenched and very difficult to change.

One lost opportunity of the cognitive health movement seems to be that it did not use the strongest argument available for behavior change in the service of

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[86] Congressional Research Service, "Official Summary," http://www.govtrack.us/congress/bills/111/s3036 (accessed November 9, 2012).

[87] U.S. Department of Health and Human Services, "National Plan to Address Alzheimer's Disease," 57, http://aspe.hhs.gov/daltcp/napa/NatlPlan.pdf (accessed November 9, 2012).

public health: *The Logically Derived Policy Argument*. Those who used this argument, Peter Whitehouse and Nancy Emerson Lombardo, warranted the use of heart-healthy behaviors to protect the brain with the fact that the heart is a pathway to brain health, backed by such evidence as the impact that cardiovascular conditions such as stroke have on cognition and the importance of perfusion and healthy vasculature to cognitive health. Because RCTs supporting behaviors for heart health have been nationally recognized, such evidence can be used in the service of heart health. The *Logically Derived Policy Argument* is much stronger than the *Epidemiologically Informed Policy Argument,* which is built on evidence for "associations" rather than on RCTs and was used by the Alzheimer's Association to drive the cognitive health movement. It is the *Logically Derived Policy Argument* that can answer the State-of-the-Science Conference Statement's *Evidence-Based Policy Argument* that there is currently no evidence on behaviors that can support cognitive health. The *Opportunity Cost Argument* can be marshaled along with the *Logically Derived Policy Argument* to show that there is a moral imperative of action in the absence of any other effective approaches.

Cognitive health promotion just got started and it remains to be seen if it will thrive as a movement. The tango between the two views of cognitive health and disease (codified as "Alzheimer's disease") has been courtly, but the disease paradigm seems to have remained dominant. The validity of the *Logically Derived Policy Argument* suggests that future cognitive health efforts might benefit from dissociating themselves from Alzheimer's disease prevention and reframing themselves instead around direct vascular pathways to cognitive health.

This approach is feasible, has not yet been tried, and appears to be the best option for immediately moving cognitive health forward within the field of public health.

Conclusion

Dr. Hugh Hendrie, a geriatric psychiatrist from Indiana University Center for Aging Research, was instrumental in the national efforts described in this dissertation to address the behavioral promotion of cognitive health at the population level. Through the 1990s he had conducted the NIH-funded Indianapolis-Ibadan Dementia Project, an epidemiological study that found that age-adjusted incidence of dementia was significantly lower among Yorubans in Nigeria than among African Americans in Indianapolis. As genetic associations with dementia were relatively weak in these populations, the findings raised the interesting question that lifestyle, in particular lower prevalence of vascular risk factors in the Yoruba, had a protective effect.[1] Starting in 2001, Hendrie served as chair of the Critical Evaluation Study Committee that conducted the critical literature evaluation for the NIH Cognitive and Emotional Health Project. In 2006 Hendrie served on the Steering Committee of the Healthy Brain Initiative,

[1] Hugh C. Hendrie, Adesola Ogunniyi, Kathleen S. Hall, Olusegun Baiyewu, Frederick W. Unverzagt, Oye Gureje, Sujuan Gao, Rebecca M. Evans, A.O. Ogunseyinde, A.O. Adeyinka, Beverly Musick, and Siu L. Hui, "Incidence of Dementia and Alzheimer Disease in 2 Communities: Yoruba Residing in Ibadan, Nigeria, and African Americans Residing in Indianapolis, Indiana," *JAMA* 285, no. 6 (2001): 739-747.

participating as well in its Surveillance Work Group. In 2010 he offered the final commentary on the Evidence-Based Practice Center Systematic Review at the State-of-the-Science Conference. I asked him if there was a narrative that linked the health promotion efforts together. He responded that health promotion "starts with an illness, in this case AD, then gets broader and broader with more and more illnesses involved, precursors are examined, such as MCI, cognitive decline, risk factors – and you regress that to cognitive health. It's a kind of reverse mirror to illness."[2] The flip in perspective narrated by Hendrie was portrayed by many researchers and policy people interviewed in this dissertation[3] and remains the central focus for a dialogue on policy options in the field of public health gerontology.

Hendrie stated and others echoed that the Alzheimer's Association provided the momentum that eventually led to the establishment of the cognitive health promotion movement: "There had to be great lobbyists and passionate constituents for it to happen. Without the Alzheimer's Association this great interest in Alzheimer's disease wouldn't have taken place. The NIA started funding Alzheimer's disease studies, and then people gradually began to think the other way around, in terms of health."[4] Spokespeople for the Alzheimer's

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[2] Hugh Hendrie, interview by author, telephone, September 15, 2011.

[3] For example, NIA Behavioral and Systems Neuroscience Branch Chief Molly Wagster stated that "[W]hat was different about the Cognitive and Emotional Health Project, what I think was different about the CDC/Alzheimer's Assn project, and to a certain extent NIA effort, the Healthy Brain Initiative, and what we hope is going on still today... is that the focus is sort of flipped. So rather than dwelling upon, or talking about, what we can do to prevent Alzheimer's disease or age-related dementia, to focus on what it means to have healthy brain function or healthy cognitive function and to be able to, importantly, define or, going back to your very first question, define or sort-of measure – how do we assess and what do we call healthy function in the community, in a community-based sample? So it's turning the tables a little bit, if you will." Interview by author, Bethesda, MD August 22, 2011.

[4] Ibid.

Association also talked of a shift in thinking from an exclusive focus on Alzheimer's as defined by amyloid plaques and neurofibrillary tangles to a realization of vascular co-occurrence, a set of common risk factors associating heart disease and Alzheimer's disease, and additional associations with depression and diabetes that have not been discussed in this dissertation. As the disease construct lost its distinct boundaries, it began to seem easier to ask *What is cognitive health?* than *What is Alzheimer's disease (and other dementias)?*

The sequence of policy arguments narrated in Chapter 4 opened with the Alzheimer's Association's suggestion that because lifestyle factors are associated with both vascular disease and cognitive decline, behaviors can be recommended to prevent both outcomes. This *Epidemiologically Informed Policy Argument* was superseded at least for the time being, by the much stronger *Evidence-Based Policy Argument* put forth by the State-of-the-Science Conference Statement, which found no conclusive randomized controlled trials to support any behavioral change to promote cognitive health. Although the Statement has been in part disputed using the same Evidence-based standards, the conclusions drawn seem to be a fair if unpopular reading of the RCTs available. On the face, the research question *Why have no public health recommendations been issued nationally for older Americans to maintain or promote their cognitive health?* was resoundingly answered by the State-of-the-Science Conference Statement as "lack of evidence."

The Conference's independent panel had been charged with setting aside "personal opinions and values" and "using the strength of the evidence to drive the decision, and the strength of the evidence alone. And the rationale for that is

because if we're wrong in that case, we have the potential to negatively impact millions of people."[5] This opening statement established the Conference as having far-reaching public health impact (affecting "millions of people"). At the same time, it signaled that its standards (RCTs hierarchically superseding epidemiological evidence) were "the" evidence "and the evidence alone" that established public health truth.

As we have seen in this dissertation, several other arguments were made for public health action warranted by different kinds of evidence (epidemiology in combination with RCTs, multiple methods evaluated with something akin to Keith Tones' "judicial review," and a more logically-based use of RCTs for diseases that have cognitive impairment sequelae). The interviewees justified the use of alternative methodologies on two grounds: first, on the grounds that RCTs by themselves are flawed and incomplete as all research methods are incomplete, and second, on the grounds that the wider biopsychosocial context urgently calls for creative problem solving. The answer to the call for caution because "if we're wrong ... we have the potential to negatively impact millions of people" was a moral imperative that action is needed. Under the population aging scenario predicting a great increase in cognitive impairment and a wider circle of affected people, we should reconsider the standard that harm can only be done through action. The default of inaction is forecasted to negatively impact millions of people with the passage of time, adversely affecting our nation as a whole.

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[5] U.S. Department of Health & Human Services, "NIH State-of-the-Science Conference: Preventing Alzheimer's Disease and Cognitive Decline – Day 1," NIH VideoCasting and Podcasting, CIT File ID: 15839, 3:33, http://videocast.nih.gov/launch.asp?15839 (accessed November 7, 2012).

RCTs were recognized for their central importance in establishing the effectiveness of interventions. Manly strongly endorsed the NIH standard that RCTs alone can separate behavior from type of person who might tend to perform the behavior (in her example, rich people who buy certain foods may be healthier but we do not know if it is the wealth or the food that is protective without a randomized trial involving all types of people, including rich and poor). However, a number of interviewees challenged the RCT paradigm as flawed in its own ways. Whitehouse noted that RCTs require "NIH super volunteers" in order not to eliminate as many confounding variables as possible, samples that do not represent the real population of aging Americans. Hendrie also noted that such trials are not complete or representative. Using a drug testing protocol, the model for evidence-based research and practice, very careful case controlled studies are to be followed by the translation into clinics to do effectiveness trials. But "these are seldom done....This takes 10-20 years and is a messier process."[6] Hendrie implies that without effectiveness trials drug trials are incomplete yet drugs are approved without this second step. The comment raises the specter of a double standard as, for example, in the case of the ACTIVE trial that was deemed modestly effective but "the sustainability of these behaviors must ... be assessed in large, community-based samples, in which other, less rigorous interventions showed no benefit."[7]

Others stated that RCTs were too high a standard to meet under the circumstances we find ourselves in, on the verge of a dementia epidemic. Rabins

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[6] Hugh Hendrie, interview by author, telephone, September 15, 2011 interview.
[7] Daviglus et al., *State-of-the-Science Conference* Statement, 16.

was most eloquent on this subject noting that trials are not feasible for various reasons, including the decades needed to prove results with cognition, the prohibitive cost, and most importantly the ethical impossibility of creating control groups that do not engage in the healthful behavior for a number of decades. Thies argued that in the wake of the State-of-the-Science Conference Statement, trials for cognitive health interventions were far less likely to be funded. Indeed, it seems that the State-of-the-Science Conference fueled arguments that drug trials directed at treatment should given priority over behavioral research directed at prevention, as evidenced by the O'Connor, Prusiner, and Dychtwald editorial "The Age of Alzheimer's"[8] and by the text of the National Alzheimer's Project Act. Thies indicated that he would not have regretted if the conference had never been held.[9]

Indeed, it is not clear why the NIH Panel addressed a health promotion question, *What are the therapeutic and adverse effects of interventions to improve or maintain cognitive ability or function?* at a conference centered on disease prevention. Attempting to address health promotion outcomes with the same evidence used for disease prevention seemed to shortchange the topic of healthy cognition. According to Thies, the State of the Science conference is "designed to answer a specific question: Is the evidence for this intervention adequate to support the intervention or not? Or does the evidence prove the value of that intervention? And that works fine in a very medical setting and doesn't work so well in a setting that's more public health than it is specific

[8] O'Connor et al, "The Age of Alzheimer's," A.33.
[9] Bill Thies, interview by author, Chicago, IL, December 5, 2011.

medicine." Others, such as Manly noted that the requirements that the independent panel be outside of the field of cognition made it very difficult for them to evaluate a topic that was much more complex than those tackled by other conferences.[10]

Providing an answer to the health promotion question arguably foreclosed deeper investigation of cognitive health promotion at the national level, at least for the time being. The inclusion of the question reduced the full richness of possibilities in the approach laid out by the NIH's own *CEHP Report*. That report had drawn from a database of NIH-funded research and noted very few studies that were centered around positive cognitive and emotional outcomes, likely reflecting a "disease-oriented focus [that] is represented in the current priorities of the NIH."[11] In the context of all of the efforts conducted at the national effort, the CEHP report reads like a manifesto for a new paradigm of successful cognitive and emotional aging that got lost in subsequent efforts.

From the perspective of the report, research that attempts to preserve cognition in an older population may be working with a different set of risk factors and prevention strategies that those focusing on single disease outcomes.[12] Unfortunately "research into the factors involved with healthy brain aging has lagged well behind research into understanding brain disease."[13] The

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[10] "...the outcome of Alzheimer's disease has all these complexities in how do you define it, how you differentiate it in life between normal aging and not normal aging, so I think that the independent panel was struggling with that to some extent....It's a difficult hurdle to overcome when you're trying to, you know, get across your scientific norm to them. [A State of the Science question] in OBGYN [was], do you have the cancer or do you not? It's much more complicated for us in some ways." Jennifer Manly, interview by author, New York, NY, October 11, 2011.

[11] Hendrie et al., *CEHP Report*, 21.

[12] Ibid., 26.

[13] Ibid.

report ends with a call for a paradigm shift that would focus on successful cognitive and emotional aging:

> As our society transforms the model of aging from "survival" to "successful," there may be a revolution in ideas about what constitutes cognitive and emotional aging. Do resilience, mastery, self-efficacy, and vitality cover the conceptual landscape? What should be the range for expectations about successful cognitive and emotional health in the elderly? Biomedical researchers should join forces with investigators from other disciplines such as social sciences and bioethics, among others, to create a new concept.[14]

In this passage the authors allude to population aging, a process of extended life expectancy across the population that is raising expectations for quality of life. They point to aspects of health that can be considered "a resource for everyday life" as Lester Breslow called it,[15] in keeping with the cutting edge of health promotion. Although the passage mentions resilience, mastery, self-efficacy and vitality, the authors earlier define and discuss the concept of cognitive reserve which also fits with the idea of health resources for everyday living. Finally, the authors ask for interdisciplinary collaboration in the defining of successful cognitive and emotional aging. Overall, the authors suggest that the idea has to be born in the imagination before it can be developed scientifically, and much more work needs to be done on this front.

The call for the creation of a new concept concedes that we are still only at the inception of this form of health promotion. Even in 2012 I would say that very little has changed. This project has examined the disciplinary intersection between gerontology and public health in relation to promoting cognitive health

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[14] Ibid., 28.
[15] Breslow, "From diseases prevention to health promotion," 1031.

in older adults. As my introductory literature search showed, this intersection has received very little attention to date.

Another answer to the question *Why have no public health recommendations been issued nationally for older Americans to maintain or promote their cognitive health?* is that the public health effort for cognitive health emerged out of four relatively new areas of professional practice without clear agreed-on standards: health promotion within public health, successful aging within gerontology, evidence-based practice within public health, and cognitive health within neuroscience and related fields. These areas have a clear need to define their terms, measures, and theories, and especially their goals and outcomes. Though many arguments that have been forwarded to issue recommendations for cognitive health, very little work has been done to specify the outcome. Therefore another reason why there have been no national public health recommendations older Americans to maintain or promote their cognitive health is that we do not know what cognitive health means and so we do not know what our national goal is. The starting point of the question *What are the therapeutic and adverse effects of interventions to improve or maintain cognitive ability or function?* would appear to be *What is cognitive ability or function?* It is unlikely that the answer to this question can be answered in strictly empirical terms. Instead, it is really a matter of opinions and values that can be negotiated into consensus on the desired outcomes. For this reason, a discussion of opinions and values around cognitive health needs to start before evidence can even be evaluated.

In 2011 the baby boom generation of Americans started turning 65 at a rate of 10,000 a day. Currently 13.9% of those age 71 and up, or one in seven, are said to have dementia and 22.2%, more than one in five, are said to have cognitive impairment without dementia. Together, 36.1%, or more than a third, are said to have significant cognitive impairment or dementia.[16] The meaning of these terms and their consequences to Americans as a nation is critical and cannot go ignored.

Cognitive function is defined in various ways by different disciplines. As a society, do we want it to be defined as "firing" frontal lobes as seen in functional MRI imaging? On a neuroscientific level, it could be defined as absence of white matter hyperintensities or brain infarcts, absence of amyloid plaques or neurofibrillary tangles, or presence of large brain volume or dendritic density, among other possibilities. On a physiological level, it could be defined as healthy vasculature and perfusion. On a neurological and behavioral level, cognitive health could be a good score on various dementia scales such as the Mini Mental State Exam, various psychological batteries such as the Wechsler Adult Intelligence Scale (WAIS), or one of hundreds of other neuropsychological batteries. On a functional level, it could be defined as a good score on various behavioral measures such as the index of activities of daily living (ADL), the instrumental activities of daily living scale (IADL), or combinations such as the modified Blessed dementia scale (DS) and the Functional Assessment

[16] See Plassman et al., "Prevalence of Dementia," and Plassman et al., "Prevalence of Cognitive Impairment without Dementia." These figures are for 2002.

Questionnaire (FAQ).[17] It could be defined as self-reported or informant-reported satisfaction.

The HBI *Road Map*'s visual answer to *What is cognitive health?* was inadequate and off point in depicting cognitive health as smiling, laughing, making love, being in extended families, running on the beach and on the track, swimming, playing tennis, surfing, going fishing and boating and kayaking, hiking, singing, dancing, gardening, hoola-hooping, and romping like children.[18] However, the HBI's research projects provided some intriguing clues as to what the general public saw as their functional needs and desires, including being cognitive alert, being socially involved, having a positive mental outlook, and having a good memory and, more specifically, knowing all the names of an extended family, being open to new experiences such as using computers, and communicating with skill.[19] This project suggests that policymakers could also learn from cognitive wellness industry representatives who have worked closely with consumers and may be able to offer meaningful examples of what they need and want.

Among the interviewees in this study there was a near universal agreement that cognitive health means healthy functioning on an everyday level, not the possessing a pathologically free brain. This finding suggests that the outcome focus for cognitive health promotion needs to engage with discussions of cognitive enhancement as a strategy to compress morbidity. As the debate

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[17] The new NIH Toolbox attempts to provide a "standard set of measures that can be used as a 'common currency' across diverse study designs and settings." National Institutes of Health, "What and Why?" NIH Toolbox website, http://www.nihtoolbox.org/Pages/default.aspx (accessed October 22, 2012).

[18] CDC, & AA., *Road Map*, 1-64.

[19] Laditka et al, "Attitudes about aging well."

between Timothy Salthouse and Herzog et al. demonstrated in Chapter 1, changing the fundamental physiology of aging is very different from enhancing ability in order to delay the arrival at a threshold of dysfunction. If health promoters frame health as a resource for daily living, health would include compensatory strategies. Here is where negative outcomes really diverge from positive outcomes. As pathology can be detected before it manifests in behavior, a focus on biomarkers of pathology and an attempt to cure that pathology is a very different approach from delaying the manifestation through the building up of skills and knowledge. Unfortunately, the HBI has so far missed the opportunity to weigh in on this issue. Time and a tiny budget no doubt limited discussion to a few chosen priorities. But the idea of reserve runs through much of the literature that the HBI references including health promotion within public health, successful aging within gerontology, and cognitive health in neuroscience, and should be included in further iterations of the *Road Map*. A focus on reserve opens up questions about the role of education in cognitive health, both early development and continuing education and retraining throughout adulthood, and furthers the interdisciplinary collaboration potential of this national project to improve and maintain cognitive health.

What remains almost completely unaddressed by any of the efforts discussed in this dissertation is whether age-related cognitive change is matter of national concern. Although the *Road Map* states that “the changes that take place over the life span should be accepted, even embraced, as a natural part of

the aging process,"[20] differences among such constructs as "normal," "usual," "successful," "cognitive health," "cognitive decline," "mild cognitive impairment," "cognitive impairment," remain vague. Americans notice change the well-documented changes[21] and are concerned, as evidenced by polls, the common behavior of checking for signs of dementia, and the purchase of brain fitness programs among other products and services for cognitive health, as discussed in Chapter 3. It remains to be determined whether American lives are diminished by these age-related cognitive changes, especially in the face of new economic pressures to stay in the workplace longer. Which category do they fall into if not demented or cognitively impaired? What recommendations should be directed to them, arguably the most productive members of their age group?

Despite lack of consensus on categories of cognitive health and functioning and on outcome measurement methods, interviewee discourse examined with the Toulmin model of argument analysis[22] suggested a number of arguments that can be used to make public health recommendations for cognitive functioning in aging. These ranged in order of specificity based on the warranted evidence used. On one end of the spectrum was Stern's very general recommendation that cognitive, social, and physical engagement (in some combination) could be recommended to promote cognitive health, using an *Epidemiologically Informed Policy Argument*. On the other end was Rabin's specific recommendation for midlife control of hypertension, also using an *Epidemiologically Informed Policy Argument*. In the middle were recommendations for preventive heart health

[20] CDC, & AA., *Road Map*, p. 6.
[21] See Timothy Salthouse's work, include the article discussed in Chapter 2, "Mental Exercise and Mental Aging."
[22] Toulmin, *The Uses of Argument*.

behaviors (such as low-fat diet and physical activity) for cognitive health. The Alzheimer's Association recommended heart-healthy behaviors using an *Epidemiologically Informed Policy Argument*, where as Whitehouse and Emerson Lombardo recommended the same with the more powerful *Logically Derived Policy Argument*. Rebok recommended cognitive engagement based on a *Triangulated Evidence Argument*[23] and Fernandez, Merzenich, and VibrantBrains did the same claiming that good RCTs were there to recommend cognitive training using *Evidence-Based Policy Arguments*. Lastly Manly recommended physical exercise using for cognitive health using the black-box paradigm and an *Evidence-Based Policy Argument*.

The *Evidence-Based Policy Arguments* live and die by the strength of the RCTs that are used to support them. While the cognitive fitness marketers uniformly claimed that cognitive fitness works based on the ACTIVE and/or IMPACT Trials, other researchers, including Poon and Manly, questioned the meaningful impact of those trials based on small effect sizes and not accounting for individual performance variability because of reported participant averages. My own reading of these trials as presented in Chapter 2 found that vague explanation of performance scoring and conflicts of interest further cast doubt on the claimed findings. However, other aspects of these trials, such as the training effects, are impressive and could be strengthened with further evidence.

In the absence of clear RCT evidence supporting particular interventions, the clearest course of immediate public health action is to endorse behaviors to

[23] Peter Whitehouse and Nancy Emerson Lombardo also supported combination evidence, but as they offered the stronger *Logically Derived Policy Argument* I represent them with this argument type.

promote heart health because of the direct effect of cardio vasculature on cognitive health. Thus, the strongest policy argument made and one that can answer to the *Evidence-Based Policy Argument* was the *Logically Derived Policy Argument*. The *Logically Derived Policy Argument* can use the Evidence-Based evidentiary standard by pointing to RCTs that have supported proven and accepted guidelines for behavioral interventions for heart health (including the U.S. Preventive Services Task Force's guideline of 30 minutes moderate-intensity physical activity on most days of the week for cardiovascular health, including high blood pressure[24]). These same RCTs can be used to promote cognitive health with the warrant that vascular factors directly lead to cognitive outcomes. The *Logically Derived* Policy Argument makes room for common sense and logic to warrant the use of evidence accepted for one kind of problem that is a physiological pathway to another kind of problem.

My experience in both gerontological and public health circles, including those in academia, have sensitized my ear to the frequently used phrase "we can say..." and "but we can't say..." in relation to evidence. These phrases caution scientific discretion and call attention to the parameters around truth as determined by the evidence-based practice model in order to do no harm to the populace. Though very important in establishing the specific intervention recommendations, the "evidence-based" model has limitations in relation to action-oriented policy discussions that do not have access to multiple, large studies with robust findings on particular behaviors to recommend. However, I

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[24] U.S. Preventive Services Task Force, *Guide to Clinical Preventive Services, Second Edition* (Section 55).

believe there is a lot more to say than that there is no evidence for action. In opening up the discussion, we can consider general messaging based on general findings, the use of common-sense logic to combine existing evidence for new purposes, the imagining of new concepts which will involve admitting that we still do not know what the meaning or goals of cognitive health, the inclusion of people from industry who have insight into consumer needs and desires and are already marketing unproven claims, and the inclusion of other sectors across the biological and social divide such as educators, the inclusion of representatives from other national health promotion efforts, and an honest reckoning with the lack of money for the kind of trials that are required in order to "say" what can be done to promote cognitive health. Creativity not rigidity is required in the absence of adequate time or money to provide RCT results before the largest generation of Americans can benefit from the results.

This *Logically Derived Policy Argument* is needed to strategically galvanize public health action and open the door to other low-cost behavioral strategies. The *Epidemiologically Informed Policy Argument* has been too weak to stand up to the *Evidence-Based Policy Argument.* Under the Evidence-Based paradigm, epidemiology is preliminary evidence for RCTs which are then definitive. The *Triangulated Evidence Policy Argument* legitimately triangulates across multiple forms of evidence to come up with something like Tone's judicial review. However, it moves too far away from the dominant paradigm to be effective at this time.

Today the *Logically Derived Policy Argument* is the best argument to further public health action for cognitive health promotion. At this point in time

the vascular-cognitive behavioral link represents the easiest and least controversial way to make an impact on population health. This approach would add a cognitive message to already existing guidelines for lowering hypertension, engaging in physical activity, maintaining weight, eating a low-fat diet, and so forth, stating that such activities are not only good for the heart but also they are good for the brain. That such an argument appears to have been missing in the national arena is unfortunate because of lost time but is also hopeful because it points to an untried path for public health. Just stating that cognition is an outcome of vascular health would importantly acknowledge cognition as an important aspect of daily life that has been too long neglected within public health. More importantly, if messages for cognitive health provide extra motivation for Americans to create heart-healthy environments or to engage personally in behaviors for heart health, the impact on public health for millions of people could be profound.

However, in order to put forth the *Logically Derived Policy Argument* using the example of vascular health, it is likely that the cognitive health movement will need to separate itself from the Alzheimer's movement. The Alzheimer's Association is committed to the definition, prevention, treatment, care, and cure of Alzheimer's disease and its constituency of patients and caregivers. For the Association to move away from the Alzheimer's message on Alzheimer's-vascular comorbidities to focus on the direct effects of cardiovascular factors on cognition does not make sense. Similarly, the health effort to promote physical activity for both cardiovascular and cognitive health, I believe, cannot currently move forward with the Alzheimer's-cardiovascular disease comorbidity

model. Only by removing Alzheimer's disease from the equation can the *Logically Derived Policy Argument* be used to make a valid health promotion claim that can be acted on immediately. Pursuit of this approach would perhaps provide an opportunity for another organization to take the lead.

The National Institute on Aging, the National Institute of Mental Health, and the National Institute of Neurological Disorders and Stroke were visionary in launching The Cognitive and Emotional Health Project in 2001, but some of its message got lost with the congressional endorsement of an Alzheimer's Association cognitive health effort. Re-emphasizing and developing the original health-based approach could offer hope to a panicked populace, present new avenues of collaboration for both researchers and policymakers, and develop a foundation for a new economy build around health not disease.

Appendix

Profiles of Cognitive Health Experts Interviewed

Lynda Anderson, Ph.D.: Director of the Healthy Aging Program, Division of Population Health within the National Center for Chronic Disease Prevention and Health Promotion at the Centers for Disease Control and Prevention, Atlanta, GA. Dr. Anderson led the establishment of The Healthy Brain Initiative and served as co-chair on the first roadmap, titled the *Healthy Brain Initiative: A National Public Health Road Map to Maintaining Cognitive Health* (2007). Dr. Anderson is an Adjunct Associate Professor at the Rollins School of Public Health at Emory University.

Matthew Baumgart: Senior Director of Public Policy at the Alzheimer's Association, Washington, DC, Public Policy office. At the Association since January 2009, Baumgart took over management of the Healthy Brain Initiative for the Association in November 2009.

Nancy Emerson Lombardo, Ph.D.: Owns and operates Health Care Insights, LLC, which markets Memory Preservation Nutrition® and healthy cognitive aging services. She is also an Adjunct Research Assistant Professor of Neurology at the Boston University Alzheimer's Disease Center, Boston, MA. Emerson Lombardo was a board member of the national Alzheimer's Association for 16 years and is one of the founders of Alzheimer's Disease International, a worldwide advocacy organization.

Alvaro Fernandez, M.A.: CEO of SharpBrains, a market research company that tracks the brain fitness industry, now based in Washington, DC. Fernandez traces his intellectual lineage from Lev Vygotsky, who championed constructivist learning, to Alexander Luria, the first neuropsychologist in Russia whom Vygotsky mentored, to Elkhonon Goldberg, his business partner and SharpBrains Chief Scientific Advisor who was mentored by Luria in Russia, to himself.

Felicia Fuller, Ph.D.: Public health researcher who has a background in studying women and HIV. She served as project manager for the Alzheimer's Association's Healthy Brain Initiative Demonstration Project (HBI) that took place in Atlanta, GA, and Los Angeles, CA.

Hugh Hendrie, M.B., Ch.B., D.Sc.: Geriatric psychiatrist and health services researcher at Indiana University and the Regenstrief Institute, Inc., Bloomington, IN. Chair of the Critical Evaluation Study Committee that conducted the critical literature evaluation for the NIH Cognitive and Emotional Health Project. In 2006 Hendrie served on the Steering Committee of the Healthy Brain Initiative, participating as well in its Surveillance Workgroup. In 2010 he offered the final commentary on the Evidence-Based Practice Center Systematic Review at the State-of-the-Science Conference.

Jennifer Manly, Ph.D.: Associate Professor of Neuropsychology, Department of Neurology, the Sergievsky Center and the Taub Institute, Columbia University, New York, NY. She spoke at the State-of-the-Science Conference on Preventing Alzheimer's Disease and Cognitive Decline. She lists her research interests as 1) cognitive test performance of African American elders, 2) literacy as a proxy for cognitive reserve, and 3) literacy and working memory.

Stephen McConnell, Ph.D.: Ageing Program Policy and Advocacy Program Executive for the Atlantic Philanthropies, Washington, DC, and former Vice President for Advocacy and Public Policy at the Alzheimer's Association. Co-chaired the Steering Committee of the Healthy Brain Initiative in conjunction with Lynda Anderson. McConnell was previously Chief of Staff for the U.S. Senate Special Committee on Aging and was a staff member of the U.S. House of Representatives Select Committee on Aging.

Michael Merzenich, Ph.D.: CEO of Posit Science, San Francisco, CA, and neuroscientist in the area of brain plasticity. Merzenich had launched what is now the largest company in the K-12 market for brain health and fitness software, Scientific Learning Corporation (SLC). Eventually Merzenich moved on from SLC to start a new company, Posit Science that targeted adult consumers, and retired from his research career at University of California San Francisco.

Leonard Poon, Ph.D.: An experimental cognitive aging psychologist and Professor Emeritus, Institute of Gerontology, University of Georgia, Athens, GA. His primary research area funded by NIMH and NIA is focused on survival and longevity of the oldest old, the Georgia Centenarian Study. His research includes every-day memory processes in the elderly, cognition and speed of behavior in older adults, clinical memory assessment, cognition in and survivorship of the oldest-old, and changes that occur in cognitive systems with Alzheimer's disease.

Peter Rabins, M.D., M.P.H.: The Richman Family Professor for Alzheimer's and Related Disease and Co-Director, Division of Geriatric Psychiatry and Neuropsychiatry, Johns Hopkins School of Medicine, Baltimore, MD, where he has been on faculty since 1978. Member of the Healthy Brain Initiative Prevention Research Workgroup. Co-author of *The 36-Hour Day* (1981, 1991, 1999, 2006), *Practical Dementia Care* (2000), and *Getting Old Without Getting Anxious* (2005).

George Rebok, Ph.D.: Professor, Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, and one of the principal investigators of the ACTIVE Trial. Rebok states that his research interests are 1) identification of early risk and protective factors on later life cognitive health and daily function, 2) prevention of age-related cognitive decline, memory loss, depression, and disability, and 3) study of the short- and long-term outcomes of cognitive intervention trials with children and with normal and impaired older adults.

Lisa Schoonerman: Co-Founder of vibrantBrains, a "brain gym" in San Francisco, CA. Schoonerman is a former publishing executive who held a variety of technical and editorial positions with the Thomson Corporation in the Legal Publishing division. Schoonerman also volunteers as a mentor for FirstGraduate, a Bay Area non-profit whose mission is to help kids graduate from high school and become the first in their families to graduate from college.

Yaakov Stern, Ph.D.: Division Leader of the Cognitive Neuroscience Division of the Sergievsky Center, Professor of Clinical Neuropsychology (in Neurology, Psychiatry, and Psychology, in the Sergievsky Center and the Taub Institute), Columbia University, New York, NY. He lists his research interests as cognitive reserve, cognitive intervention in normal aging, and the heterogeneity of Alzheimer's disease.

William Thies, Ph.D.: Chief Medical and Science Officer, Alzheimer's Association, Chicago, IL, who served on the Prevention Research Workgroup for the Healthy Brain Initiative. Dr. Thies played a key role in launching *Alzheimer's & Dementia: The Journal of the Alzheimer's Association* and in establishing the Alzheimer's Association Research Roundtable, a consortium of senior scientists from industry, academia and government. Prior to joining the Alzheimer's Association, Dr. Thies held faculty positions at major universities and served at the American Heart Association.

Molly Wagster, Ph.D.: Chief, Behavioral and Systems Neuroscience Branch, the National Institute on Aging, Bethesda, MD, and a behavioral neuroscientist. She serves as the NIH Project Officer for the development of the NIH Toolbox for Assessment of Neurological and Behavioral Function and directs the trans-NIH Cognitive and Emotional Health Project. She describes her research interests as centered on individual differences with age in cognitive domains.

Peter Whitehouse, M.D., Ph.D.: Professor of Neurology at Case Western Reserve University, Cleveland, OH, and author of *The Myth of Alzheimer's: What You Aren't Being Told About Today's Most Dreaded Diagnosis*. Whitehouse was the founder of the University Alzheimer Center (now the University Memory and Aging Center) at Case Western Reserve University and University Hospitals Case Medical Center. Whitehouse is also a founder with his wife of The Intergenerational School, an innovative urban public school in Cleveland.

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