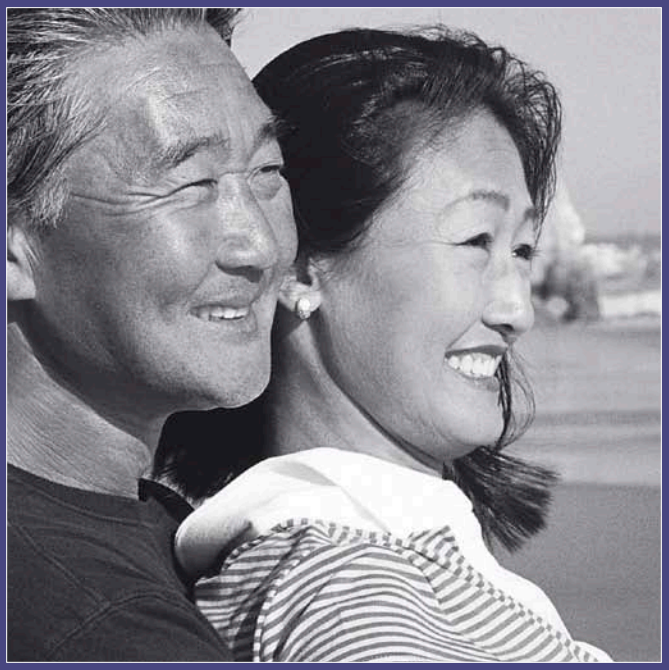

The Healthy Brain *Initiative*

A National Public Health Road Map to Maintaining Cognitive Health

CDC
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alzheimer's association

The Healthy Brain Initiative:
A National Public Health Road Map to Maintaining Cognitive Health

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Suggested Citation: 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

Available at www.cdc.gov/aging and www.alz.org

Acknowledgements

We thank the members of the Steering Committee for giving countless hours to think about and discuss this *National Public Health Road Map to Maintaining Cognitive Health;* their contributions have been invaluable.

Lynda Anderson, PhD (Cochair)
Centers for Disease Control and Prevention

Stephen McConnell, PhD (Cochair)
Alzheimer's Association

Frank Bailey, JD
AARP

William F. Benson
Health Benefits ABC's

Debra Cherry, PhD
Alzheimer's Association

Greg Case
Administration on Aging

Hugh C. Hendrie, MB, ChB, DSc
Indiana University Center for Aging Research
Regenstrief Institute, Inc.

James Laditka, DA, PhD, MPA
University of South Carolina

Debra Lappin, JD
B&D Consulting LLC

Marcelle Morrison-Bogorad, PhD
National Institute on Aging

Peter Rabins, MD, MPH
Johns Hopkins University School of Medicine

Ramona L. Rusinak, RN, PhD
Arizona Department of Health Services

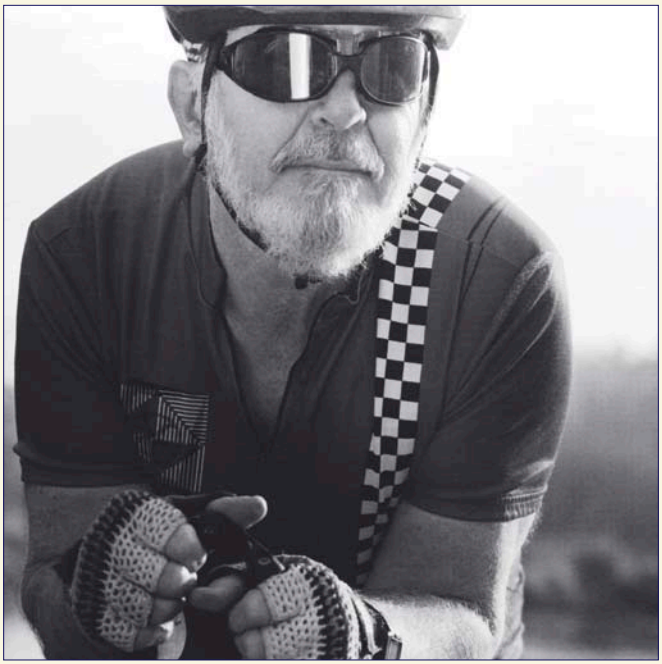
Executive Summary

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 long-term 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 like-minded 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.

Background

What is cognitive health?

The distinction between the mind and body was a concept first formally set forth in the 17th century by philosopher Rene Descartes. Over the next several centuries, the body was seen as the concern of physicians, while the mind was the purview of organized religion.[1]

Over the years, our understanding of "body and mind" has evolved significantly. We now recognize the vital role that both physical health and mental health play in shaping our overall well-being, and we appreciate the valuable contributions that a wide array of health professions can make toward assuring that well-being.

Background

Mental health encompasses emotional functioning and the ability to think, reason, and remember (cognitive functioning). While standardized, widely accepted definitions of *cognitive health* have yet to be adopted, most experts agree that the components of healthy *cognitive functioning* include:

- language
- thought
- memory
- executive function (the ability to plan and carry out tasks)
- judgment
- attention
- perception
- remembered skills (such as driving)
- ability to live a purposeful life[2]

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.[3]

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

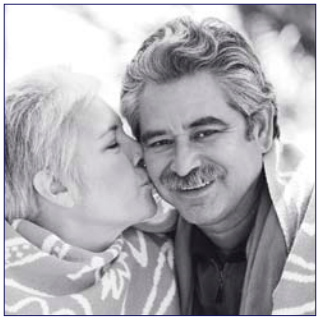
"Most important to our ability to live our lives well is the combination of mental processes we call 'cognition' or 'knowing.' This combination includes the ability to learn new things, intuition, judgment, language, and remembering. Having a clear, active mind at any age is important, but as we get older it can mean the difference between dependence and independent living." [4]

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.[5]

Why prepare a Road Map?

Bringing a public health perspective to cognitive health requires an inclusive and strategic approach. Much important work has already begun, initiated and sponsored by a variety of organizations and agencies at national, state, and local levels (see pages 10-11 for a sampling of current efforts).

Background



One of these landmark efforts, the National Institutes of Health (NIH) Cognitive and Emotional Health Project (CEHP), was officially launched in 2001. Selected experts from several universities and the NIH critically analyzed the scientific literature to identify possible risk and protective factors for maintaining cognitive and emotional health in adults.[6] In recognition of the importance of this effort, and as further testament to the increased visibility that cognitive health is receiving, Congress appropriated funds in fiscal year 2005 to the Centers for Disease Control and Prevention (CDC) to address cognitive health with a focus on lifestyle issues. With this support, CDC formed a partnership with the Alzheimer's Association and is working closely with the National Institute on Aging, the Administration on Aging, and other public and private sector organizations on a Healthy Brain Initiative.

This partnership:

- Formed a Steering Committee made up of national experts to provide overall guidance and coordination for the Initiative (Appendix A).
- Convened a Public Health Research Working Group Meeting in May 2006 on *The Healthy Brain and Our Aging Population: Translating Science to Public Health Practice*. During this 2-day invitational meeting, national experts reviewed research in public health prevention related to brain health, and discussed specific recommendations for addressing risk and protective factors for promoting cognitive health. They focused on vascular risk factors and physical activity because of their association with cognitive outcomes.

The findings from this research meeting provided a foundation and common frame of reference for the next step of the Healthy Brain Initiative: developing strategic public health recommendations. For this task, the Partnership formed work groups in four areas of public health action: Prevention Research, Communication, Surveillance, and Policy. Each workgroup was charged with drafting recommendations for moving the nation forward over the next 3-5 years toward the long-term goal of maintaining and improving the cognitive function of adults. Key stakeholders at the national, state, and local levels then refined the recommendations and selected those of highest priority (Appendix A).

The *National Public Health Road Map to Maintaining Cognitive Health* reflects the culmination of this 18-month process. As a cornerstone of the Initiative, it offers a path for how we can learn more about cognitive health and then ultimately

> "We are beginning to take the next steps, building on the research coming out of NIH and others, and moving what we know out into community practice. This is where we can make a difference in the everyday lives of Americans."
>
> Lynda A. Anderson, PhD
> *Healthy Aging Program,*
> *Centers for Disease Control and Prevention*

translate what we learn into real-world practice to improve the health of all Americans.

The authors of the Road Map recognize that in the course of daily life the domains of emotional and cognitive health are inextricably linked and cannot truly be separated. For this Road Map, however, we assume this distinction and focus solely on cognitive health. Only recently have public health expertise and resources been recognized for addressing cognitive health. The Road Map reflects a commitment to bring the area of cognitive health "up to par" with emotional health as treatments and preventive strategies become available. It is the first step in a systematic process for bringing cognitive and emotional health together in a more comprehensive and coordinated public health approach.

A Sampling of Current Efforts

Pursuing Research on Factors Influencing Cognitive Health

The National Institutes of Health (NIH) is funding ongoing research to clarify the relationship among minimizing vascular risk factors, exercise, other lifestyle and drug interventions, and cognitive health status. Epidemiologic studies are identifying likely risk and protective factors; these are being tested in animal studies, which also can help identify the mechanisms by which risk and protective factors might work. In order to confirm that the encouraging interventions identified in epidemiology and animal studies could actually maintain cognitive health if applied to humans, clinical trials must be carried out. Some are already in progress but others are still only in the planning phase. NIH keeps the public up-to-date on the current state of the science through operation of a Web site and a national clearinghouse.

Assessing Public Perceptions

Formative research with diverse groups is required to help gain understanding on the public's perceptions about cognitive health. One such effort is currently under way with the support of CDC. The Healthy Aging Research Network, within its larger Prevention Research Centers Program (PRC-HAN), conducts prevention research on a variety of health issues involving older adults. Within the PRC-HAN, members are collaborating on a series of focus groups designed to identify how diverse groups of older adults understand cognitive health and what approaches to health promotion and disease prevention related to brain health the public may find most appealing. This project has recently been expanded to examine the perceptions of caregivers and health care providers. It will provide important data that can be added to what is already known about cognitive or brain health, identify gaps in knowledge about cognitive health and related risk factors, and determine whether such beliefs vary across geographical distances and between diverse populations. Finally, this work is designed to lead to the development and testing of a short set of questions that can be used to assess the public's and possibly providers' perceptions about cognitive health for inclusion in ongoing national attitudinal surveys.

Conducting Community Education Programs

The Alzheimer's Association has recently launched a 5-year community-based demonstration project to promote a brain-healthy lifestyle. The community intervention is designed to affect knowledge and attitudes among African American baby boomers related to physical activity and vascular risk factors, and it will be overlaid with other general health behaviors such as diet, social activity, and mental activity. During the first phase of this project, the Alzheimer's Association is leading a comprehensive intervention planning and development effort, including formative research to assess current needs and obstacles for the target population, eliciting community input and participation, and creating a comprehensive, multilevel community intervention with robust evaluation mechanisms to measure the effectiveness of the public health program in its next phase.

Developing Common Measures of Cognitive Decline for Surveillance and Research

The National Institutes of Health is leading an initiative to develop unified and integrated methods and measures of cognitive, emotional, motor, and sensory health for use in large cohort studies and clinical trials. Researchers have expressed the need for brief assessment tools that could be used as a form of "common currency" across diverse study designs and populations. This initiative will take advantage of state-of-the-art psychometric research and novel testing methods to develop an innovative approach to neurological and behavioral health measurement. Ultimately, it is hoped that this approach will respond to the needs of researchers in a variety of settings, with particular emphasis on measuring outcomes in large longitudinal and epidemiologic studies and prevention or intervention trials across the life span. With an available toolbox of measures, yields from large and very expensive studies can be maximized by allowing a much larger number of important research questions regarding neurological and behavioral health to be studied. By ensuring that the assessment methods are capable of comparison to existing and completed studies and can incorporate future modifications, a truly "economic" and valuable national resource for the entire neuroscience community will result.

Why is it important—and why now?

The *National Public Health Road Map to Maintaining Cognitive Health* comes at a critical time, given the dramatic aging of the U.S. population, the growing scientific interest in the role of lifestyle strategies in maintaining cognitive function, and increasing awareness of the significant health, social, and economic burdens associated with cognitive decline.

An aging population

Age is a risk factor for cognitive decline. In 2004, one in every eight Americans—36.3 million—were aged 65 years or older. By 2030, this number is expected to nearly double to 71.5 million. At that time, 20% of the population will be in this age group.[7]

Growing fear and concern about memory loss

There is considerable concern among Americans about the loss of cognitive health to disease or disability,[8] a concern that seems to increase with age. Most older adults look forward to having a long life, and yet their greatest worries about living to age 75 revolve around memory loss.[9] According to a recent survey, adults are more than twice as likely to fear losing their mental capacity (62%) as their physical ability (29%).[10]

Increasing burden from cognitive decline

In the United States, the societal burden of cognitive impairment has been expressed mainly in terms of prevalence, incidence, and mortality for dementia generally or for Alzheimer's disease in particular. More recently, prevalence statistics for "mild cognitive impairment" or "cognitive impairment no dementia" have also appeared. Cognitive impairment no dementia refers to a level of cognitive impairment that is more serious than age-related cognitive impairment, but it is not as severe as Alzheimer's disease or other forms of dementia.

- Alzheimer's disease has been in the top ten leading causes of death since the 20th century.[11] Notably, the mortality rates for Alzheimer's disease are on the rise—in contrast to the rates for heart disease and cancer, which are continuing to decline.[12]
- An estimated 4.5 million Americans have Alzheimer's disease. That number has doubled since 1980, and is expected to be as high as 16 million by 2050.[13]

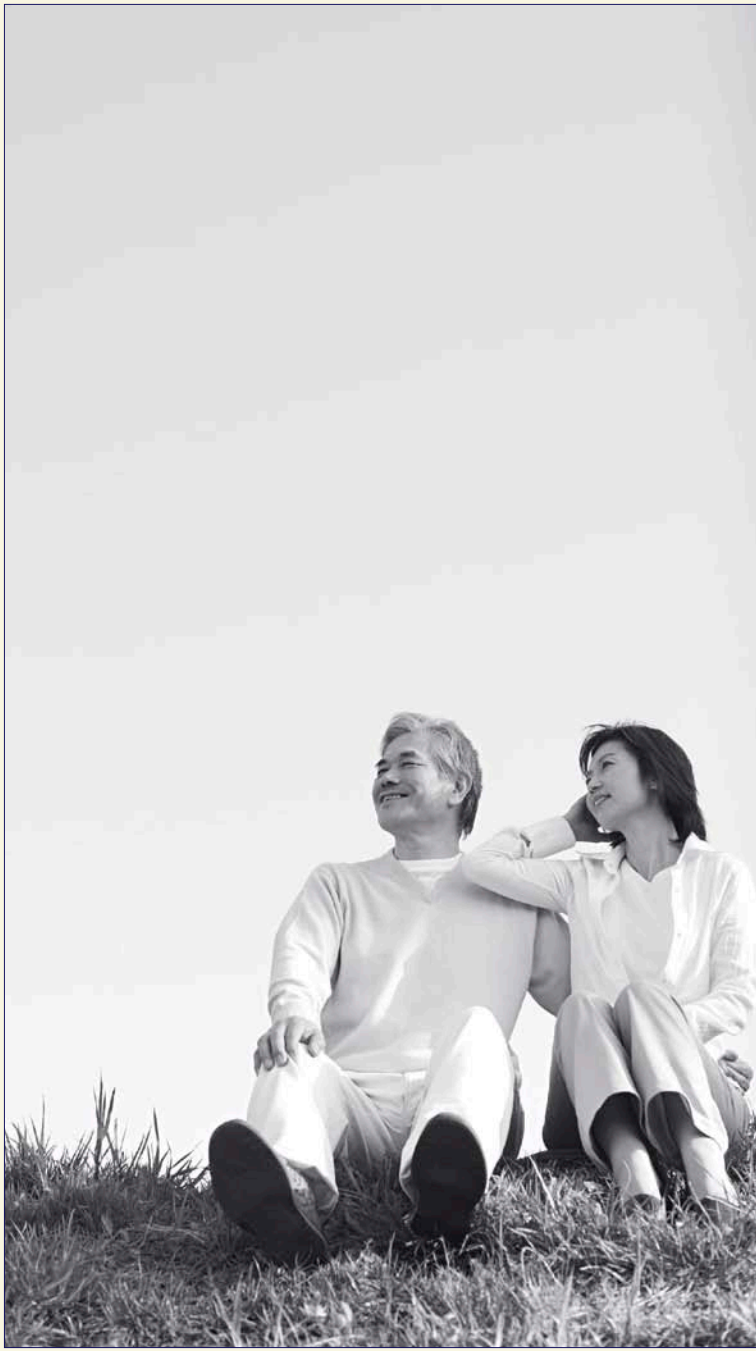
"The new science has shifted the focus to the idea that there is value in a public health strategy of getting people to think about their brain and how they might alter their behavior to keep their brain healthy."

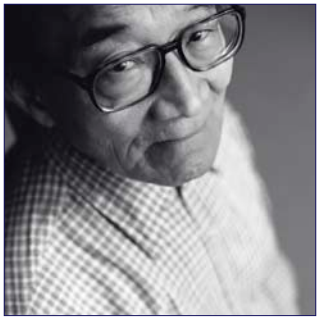
Stephen McConnell, PhD
Alzheimer's Association

- Studies from the United States and Canada have suggested that mild cognitive impairment or cognitive impairment no dementia may be a problem for 16-25% of the elderly population (65 and older).[14,15,16]
- In 2005, Medicare and Medicaid spent $91 billion and $21 billion, respectively, for persons with Alzheimer's disease.[17] According to a 2004 report that analyzed Medicare claims data, older beneficiaries with dementia cost Medicare three times more than other older beneficiaries.[18] Based on current estimates, these costs will double every 10 years.[19]

Caregiver burden

Maintaining cognitive health can mean the difference between living independently or facing the need for family or institutional care. The burden of cognitive decline on caregivers is enormous. The number of caregivers in the United States in 2003 was estimated to be 44.4 million[20] and this number is expected to rise dramatically with the aging of





the population. The costs of unpaid, informal care provided by families have been shown to account for a large proportion of the costs of treating dementia and they increase sharply as the patient's cognitive impairment worsens.[21] There are also physical and mental costs associated with caregiving; in one study, nearly 43% of the family members providing care to relatives with dementia had clinically significant levels of depression during the last few months of the patient's life.[22] Numerous factors make providing care for persons with severe dementia emotionally and physically challenging; a better understanding of these factors will aid in the design of strategies that support the health and well-being of caregivers.

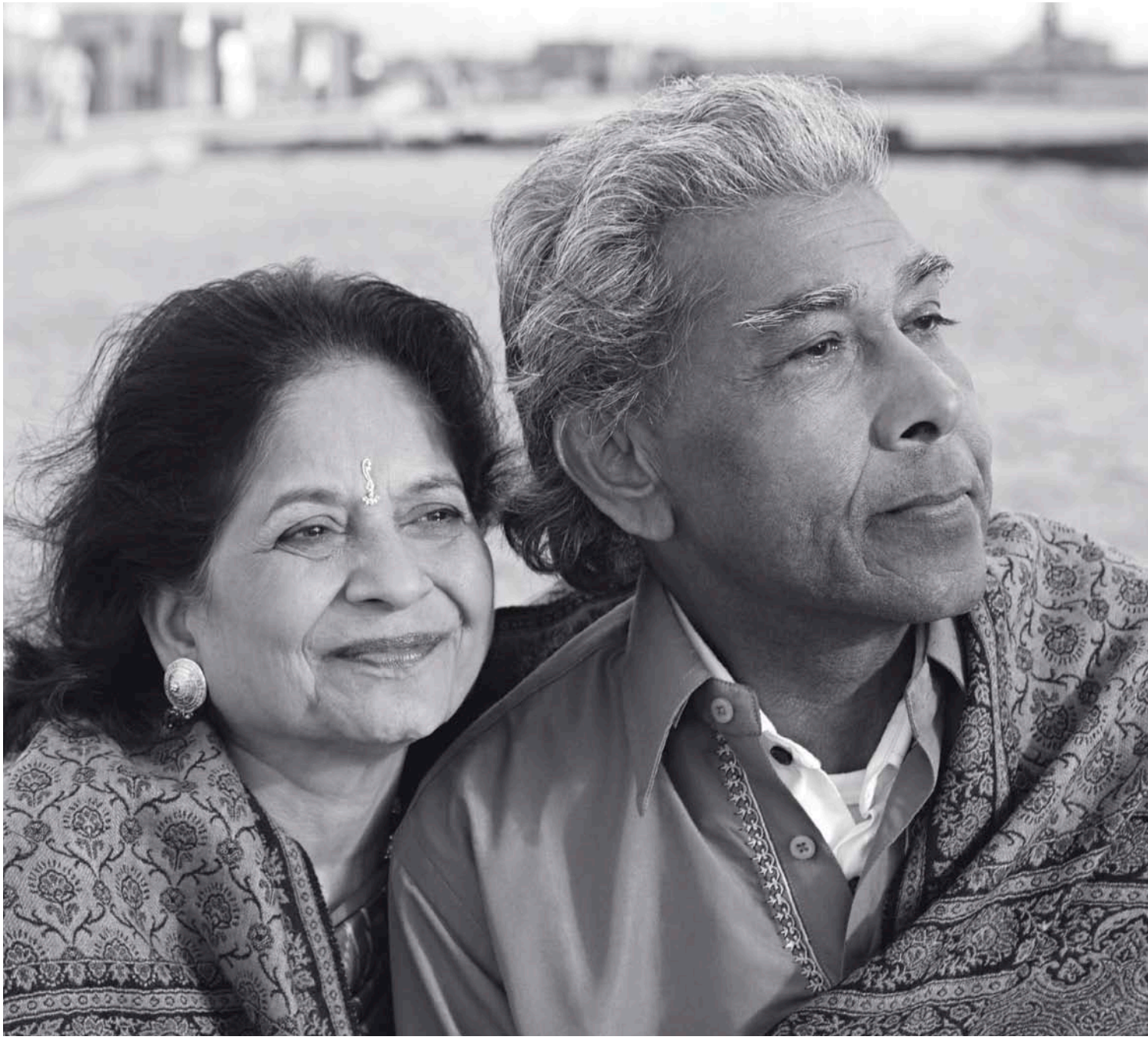
Underlying lack of information about what is known about brain health

Many adults appear to believe that aging is a time of irreversible mental decline, and that dementia is universal and inevitable. These myths persists even though recent research has shown that in the healthy aging brain, new synapses continue to form and nerve cells can regenerate.[23]

Yet, there 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.

- Nearly 9 of 10 people reported that they thought it is possible to improve cognitive fitness.[24]
- Six of 10 stated that they felt they should have their cognitive health checked routinely, much like a regular physical checkup.[25]
- More than 8 of 10 (84%) reported that they took some time nearly every day to engage in activities that may be associated with improved cognitive health: engaging in art or creative projects, reading, keeping physically active, playing games or doing puzzles, working, or spending time with family and friends.[26]
- Over half anticipated a major medical breakthrough in discovering a cure for Alzheimer's disease within the next 20 years.[27]

Given the tremendous burdens described, their impact, and the developing science, public health should step forward to address cognitive health. The potential contribution 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.[28, 29, 30, 31]



State of Knowledge

What do we know?

In May 2006, CDC and the Alzheimer's Association invited national experts to review research on public health prevention related to cognitive health, and to identify specific recommendations for addressing risk factors that promote and protect cognitive health. During this meeting, participants examined the current state of science concerning major risk factors, including: a) risk factors for vascular disease and b) physical inactivity, and they looked at current models for moving science into public health practice. Participants focused on these factors because of their association with cognitive outcomes.[32] They concluded that research suggests the following factors may be associated with the maintenance of cognitive health: 1) preventing or controlling high blood

pressure, cholesterol, diabetes, overweight, and obesity; 2) preventing or stopping smoking; and 3) being physically active.[33]

Several specific observations were noted by meeting participants regarding the associations between vascular risk factors and physical inactivity and cognition.

- Evidence exists to indicate that cumulative risks for vascular disease increase the risk for stroke and cognitive decline.
- Sufficient evidence also exists to support the association between vascular health and cognitive health, although clinical trials are necessary to establish the effectiveness of interventions targeted to vascular risk factors.
- It is important to emphasize that controlling vascular risk factors is associated with reduction in an individual's risk of cognitive problems, but current science does not support the relationship between controlling vascular risk factors and improved cognitive function.
- Growing evidence exists that physical activity may maintain or improve some aspects of cognitive function in the short term, but further research is needed both to determine long term outcomes and the nature of recommendations (e.g., the amount of physical activity).
- Strong evidence exists to support the relationship between physical activity and emotional well-being.

While not a specific focus of the May research meeting, additional factors that may be associated with maintaining cognitive function include social engagement, a "heart-healthy" diet, and emotional supports. In addition, higher household and community socioeconomic levels in early life are associated with higher levels of cognition in late life but not with the risk of Alzheimer's disease or rate of cognitive decline.[34]

What gaps exist?

Each new discovery in maintaining cognitive health raises a host of important questions. Some of the more pressing issues are the following:

- How do we promote the importance of cognitive health issues to key constituencies and stakeholders?
- What are the public's perspectives on lifestyle behaviors, choices, and attitudes concerning cognitive health and the burden of cognitive decline? What do we view as the benefits

"All the things that we know are bad for your heart turn out to be bad for your brain."

Marilyn S. Albert, PhD
Johns Hopkins Medical Institutions

and barriers of modifying personal lifestyle to reduce the risks associated with cognitive decline?

- What is the role of population-based surveillance and the appropriate surveillance systems to assess cognitive decline?
- What clinical trials and other research are needed to determine the long-term outcomes of lifestyle interventions on particular cognitive functions?
- How do we link scientifically valid messages about risk of cognitive decline to current public health messages for efforts in primary prevention?
- What are the effects of modifying multiple risk factors on minimizing cognitive decline or improving cognitive function?

How can public health contribute?

Public health was first defined in 1926, as "the science and art of preventing disease, prolonging life and promoting health and efficiency through organized community effort." [35] That definition has remained intact for over 80 years, with a recent reiteration of public health's mission as "assuring conditions in which people can be healthy."[36]

Organized public health efforts over the past 100 years have yielded remarkable achievements. Ten considered to be among the greatest[37] are in the areas of:

- Vaccination
- Motor-vehicle safety
- Safer workplaces
- Control of infectious diseases
- Decline in deaths from coronary heart disease and stroke

- Safer and healthier foods
- Healthier mothers and babies
- Family planning
- Fluoridation of drinking water
- Recognition of tobacco use as a health hazard

These achievements were possible because of combined, coordinated efforts to apply three core public health functions: assessment, policy development, and assurance.

Assessment calls for regularly and systematically collecting, analyzing, and sharing information on the health of a community. Such information helps to describe and understand a community's health status and needs. Assessment activities might involve investigating adverse health effects and health hazards to identify the magnitude of a health problem, its location, trends over time, and populations at risk. They may also "dig deeper" to analyze determinants of identified health problems so as to illuminate etiologic and contributing factors that place certain population groups at risk for adverse health outcomes.

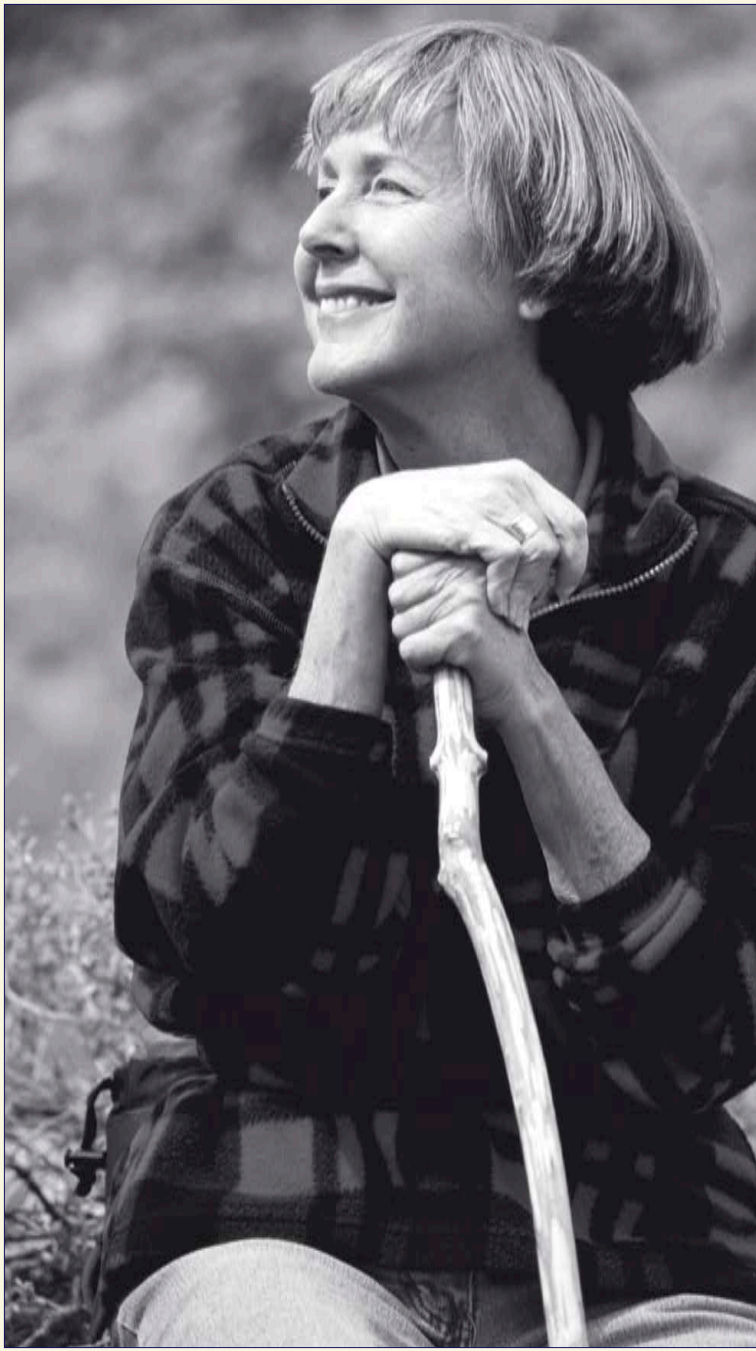
Policy development entails promotion of public health policies that are grounded in science-based decision making. By taking the lead in policy development, public health serves as an advocate, builds constituencies, and identifies resources in a community as it generates supportive and collaborative relationships with public and private agencies. Another critical policy activity involves helping communities set priorities among health needs based on the size and seriousness of the health problems and the acceptability, economic feasibility, and effectiveness of interventions; the community can then develop plans and policies to address those priorities.

Assurance is the guarantee that services needed to achieve agreed-upon goals are actually provided. It is pursued by encouraging the actions of others (public or private), requiring action through regulation, or by providing services directly. This third core public health function encompasses managing resources and developing organizational structures; implementing programs for priority health needs; and evaluating and providing quality assurance to ensure that programs are consistent with plans and policies—or that needed corrective actions are taken promptly. In addition, assurance activities help to inform and educate the public on health issues of concern; promote awareness of public health services; and promote health education initiatives that contribute to individual or collective changes in health knowledge, attitudes, and practices that make for a healthier community.

"If you could give people information and tools that would delay the onset of cognitive impairment by a few years, you would be doing much to improve individuals' quality of life as well as improving society."

Debra Cherry, PhD
Alzheimer's Association

The application of these public health functions to cognitive health offers hope of similar achievements as scientific knowledge advances. The area of cognitive health is gaining increasing attention from multiple perspectives and represents a blossoming arena for research and action. By embracing cognitive health as a priority issue, the public health community would be mobilized to study, identify and implement effective interventions that preserve this key component of health. Our challenge is to offer a systematic approach that will assure a coordinated and unified national effort. The Road Map meets that challenge by laying out a shared vision for a "work in progress," one that builds on the foundation of the work done to date, establishes a framework within which to view the findings of that work, links related and complementary activities, and shapes the work of the future.



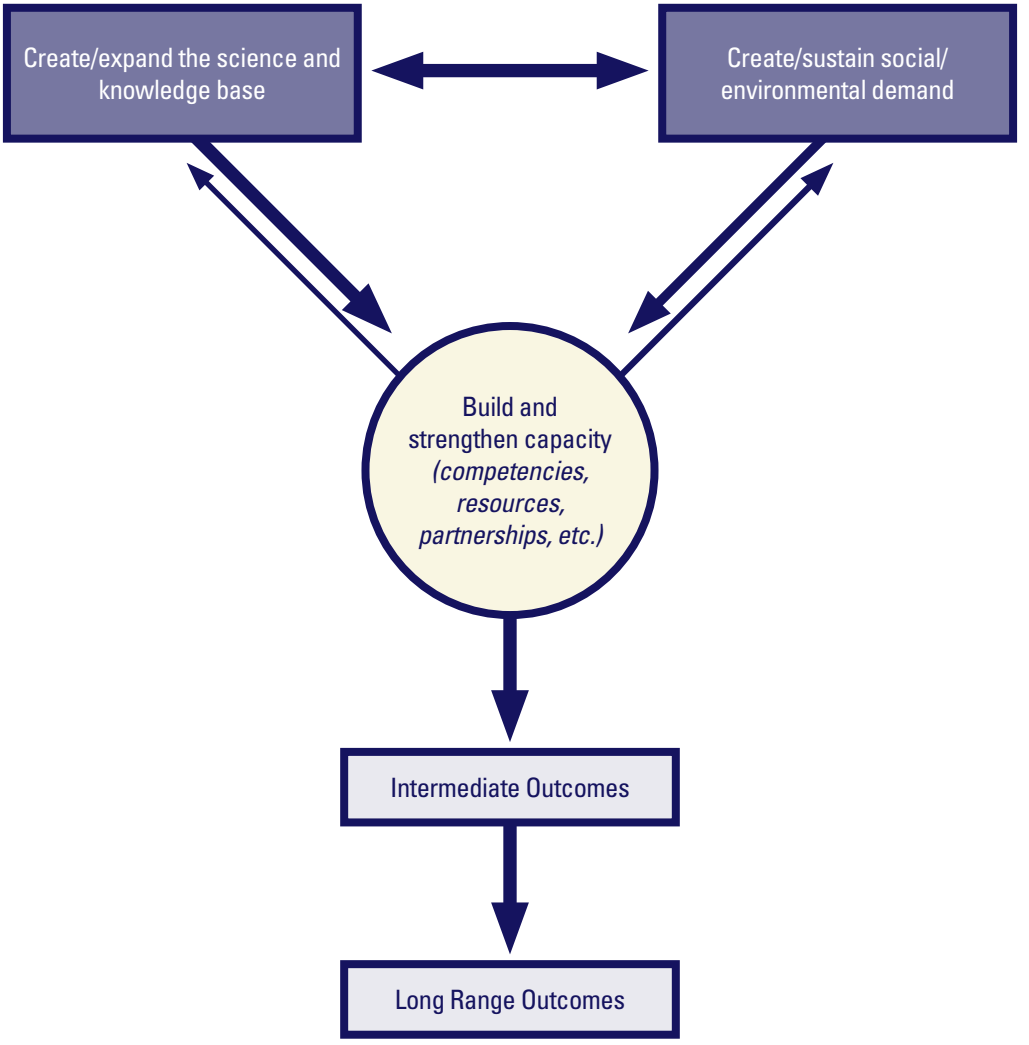
Strategic Framework

What is our model for action?

To develop the Road Map, we used a "synergistic" model (Figure 1) for moving science into public health practice.[38] The model starts with the assumption that we must first understand the *existing science and knowledge base* for preserving and protecting cognitive health, determine findings ready to be moved into the public health arena, and then conduct research to fill important gaps in knowledge.

At the same time, we must analyze *social and environmental forces* that create demand and influence the acceptance of new knowledge. The push of science and the pull of the market combine to shape the *capacity*—the complement of human and financial resources—we must have in place to improve

Figure 1[39] **The Model: Moving Science into Public Health Practice**



public health practice. Strengthening and building capacity focuses on identifying key public health entities, determining the necessary competencies and resources, and expanding partnerships to mount and sustain necessary actions. Deploying this capacity effectively will lead to desired *intermediate and long-range outcomes.*

What principles do we embrace?

Several key principles underlie our approach to maintaining cognitive health.

A firm grounding in science. Epidemiologic studies followed by the testing of interventions in clinical trials with components that include cognitive assessment will show which lifestyle factors best maintain cognitive health for the population. Through population-based surveillance, epidemiology and prevention research, public health can contribute to our understanding of cognitive health and can identify promising interventions that may be effective in promoting or protecting it. The Road Map recognizes that this process is evolutionary, and it seeks to build upon what we currently know by incorporating new discoveries as they emerge.

> "The possibility of prevention in this area is so new and so exciting for families, individuals, and government."
>
> James Laditka, DA, PhD, MPA
> *University of South Carolina*

An emphasis on primary prevention. Public health focuses on reducing the factors that put people at risk of cognitive decline, while increasing the factors that promote and protect cognitive health. Thus, the Road Map focuses on interventions in health promotion and risk reduction that preserve cognitive performance—rather than prevent dementia. It recognizes the potential "synergistic" approach by integrating these interventions with other lifestyle messages and showing how they might fit with pharmacologic interventions.

A community and population approach. Public health takes a broad view and seeks to achieve lasting change in the health of entire populations, extending far beyond the medical treatment of individual people. Thus, the Road Map's recommendations are expansive in scope, and do not single out any particular people or groups for special attention.

A commitment to eliminating disparities. Racial and ethnic disparities in health and health care are well documented. The elimination of such disparities is a critical component of the national public health agenda and a key principle of this Road Map as well.[40] The numbers and proportion of older adults from diverse racial and ethnic origins in the United States are increasing. In 2003, nonwhite ethnic and racial groups represented 17% of the population age 65 and older, with that proportion projected to increase to 28% by 2030 and 39% by 2050.[41] We embrace this diversity and recognize its value in shaping policy initiatives, communication strategies and lifestyle interventions, and population-based surveillance related to cognitive health.

What do we hope to accomplish?

We envision a nation in which the public embraces cognitive health as a priority and invests in related health promotion and research. To achieve this vision, we have adopted a long-term goal and a variety of outcomes as more immediate goals.

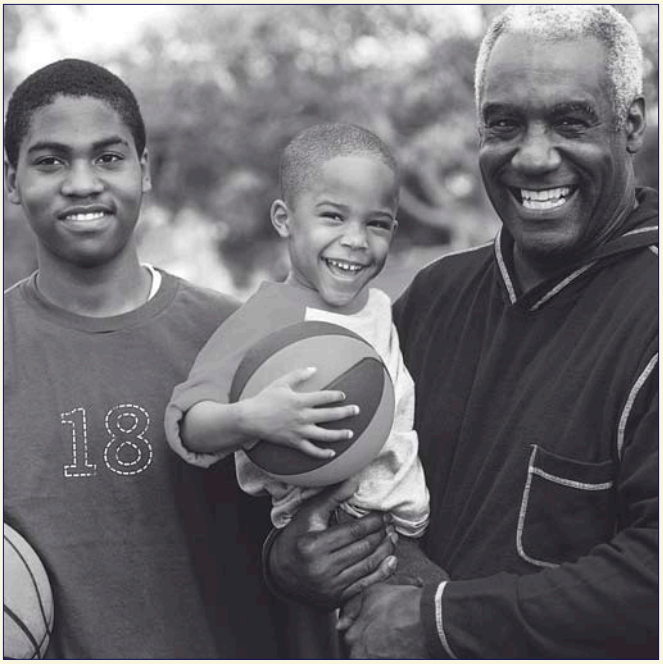
Our long-term goal is to maintain or improve the cognitive performance of all adults.

Fourteen intermediate outcomes encompass the areas of communication, surveillance, research, policy and public health capacity. These are to:

- Increase awareness about the importance of promoting and protecting cognition among the general public, public health and aging professionals, and policy makers.
- Increase knowledge about the risk and protective factors associated with cognition among the general public and public health and aging professionals.
- Decrease misconceptions and myths about cognitive health among the general public.
- Determine critical public health measures for monitoring cognitive function at the population level.
- Incorporate appropriate cognitive measures into public health surveillance systems.
- Identify the research gaps on modifiable risk factors and cognition.
- Secure sustained support for public health research to promote and protect cognitive health.

"If we maintain cognitive function over time, then we are more likely to be functionally independent."

Marilyn Albert, PhD
Johns Hopkins Medical Institutions



- Disseminate the results of critical public health research findings about cognitive health.
- Identify key public and private policies to address cognitive health.
- Modify key public and private policies to address cognitive health.
- Identify successful public health best practices on vascular health and diabetes.
- Increase cognitive health interventions that are complementary to vascular health and diabetes public health strategies.
- Secure sustained support for public health strategies to promote and protect cognitive health.
- Enhance the capacity of aging and public health service networks to implement effective interventions to promote and protect cognitive health.

Development Process

Phase I — Workgroup deliberations

Four workgroups of invited experts worked diligently and collaboratively over a 7-month period to identify recommendations in four areas of public health action: Prevention Research, Surveillance, Policy and Communication. The charge to each workgroup was to define its area of focus, identify important principles, and recommend actions for moving the nation forward over the next 3-5 years toward the long-term goal of maintaining and improving the cognitive function of adults. The definitions and principles that emerged are presented below.

Prevention Research

Research in public health prevention is defined here as research that applies and tests population-based interventions that have

the potential to maintain cognitive health. Recommendations for cognitive health focus primarily on two areas—vascular risk factors and physical activity—with emphasis on the need for practical clinical trials to show the benefits of vascular health interventions and physical activity on maintenance of long-term cognitive health. These areas were chosen because they are the first to emerge from population-based studies and animal research as promising areas for intervention. While the epidemiologic evidence supporting the benefits of vascular health for cognitive function is more definitive than the link regarding physical activity, both areas are worthy of attention. In addition, recent findings from clinical trials have heightened interest in the value of mental activities by showing a positive effect from cognitive training on certain cognitive domains.

Research on prevention should not be limited to these areas, however. Other areas (such as nutrition and social engagement) should also be recognized as important to address in the future. To the extent possible, research should be multidisciplinary and build on a firm understanding of how the public, health care professionals, and a variety of other partners define, perceive, and value cognitive health. In addition, research methodologies should consider how to convert results from randomized control trials to community settings; how to make clinical or evidence-based work practical; and how to translate research into public health practice.

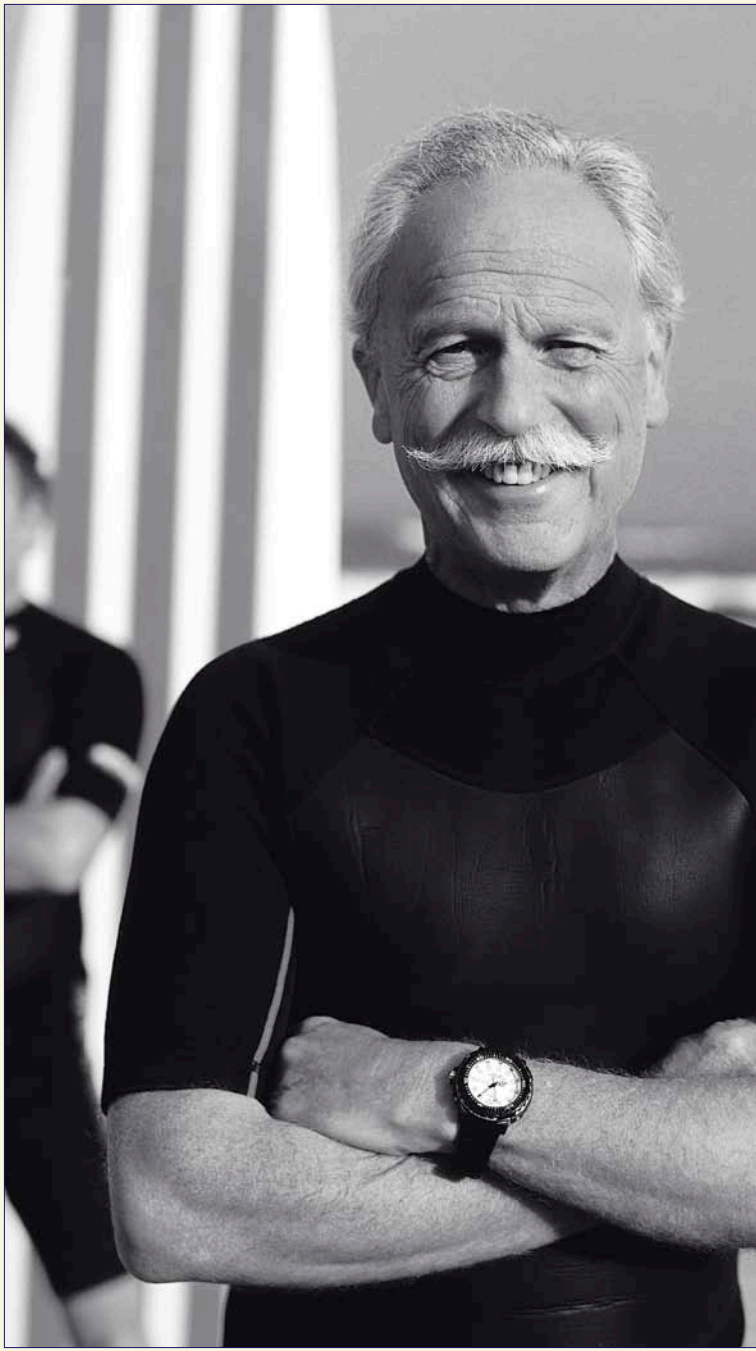
Surveillance

Surveillance is defined as "the ongoing, systematic collection, analysis, interpretation, and dissemination of health-related data."[42,43,44] The ongoing nature of public health surveillance, its application to broad populations, and limitations in resources often restrict the nature and depth of information that can be gathered through traditional surveillance methods used in research. These methods range from creating new surveillance systems to using or enhancing existing systems—and surveillance of cognitive function is no exception. Selecting appropriate surveillance methods for cognitive decline presents some unique challenges, however, such as defining criteria for a cognitive module and measuring a variety of dimensions (e.g., risk factors, attitudes, and burden of caregivers). In addition, because measurements may vary according to education, language, culture, and race or ethnicity, special care must be taken to ensure that data are not misinterpreted or misused.

Methods available for the surveillance of cognitive decline in older populations that do not rely on self-reporting face particular constraints.

Cognitive decline in individual people is directly identified through repeated measurements conducted over a period of time. To implement this method of case ascertainment in a surveillance system requires long-term follow-up of population-based cohorts with open (continuous or successive) enrollments. Such systems are not often used for chronic disease surveillance, as they are expensive and require an extensive time commitment from participants.

Repeated cross-sectional population surveys are more commonly employed in surveillance, particularly for some chronic diseases and for some risk factors for disease. Unfortunately, there are no currently established methods that definitively ascertain cases of cognitive decline through cross-sectional interviews alone. Self-reported data are inaccurate in this area, and the usefulness, availability, and validity of proxy-reported data are uncertain. Despite these limitations, such surveys have value in measuring the prevalence of risk factors for cognitive decline. They may also have potential to measure some parameters of cognitive



functions. It is possible that changes over time in the population distribution of such parameters may suggest changes in the prevalence of cognitive decline, although such inferences can only be made with caution even after controlling for confounders such as education, culture, and socioeconomic status.

Other methods of screening or identifying conditions associated with cognitive decline (e.g., genetic screening, biomarkers, and neuroimaging tests) do not yet appear practical, although some may eventually prove useful if the costs are reasonable.

Recommendations for surveillance must be offered with these methodological constraints in mind, recognizing the tension between ideal methods, for which resources may be difficult to obtain, and more limited methods, for which resources are more likely available.

Policy

Realization of the Road Map's vision requires a policy base in both the public and private sectors that supports and promotes cognitive health. The *public sector* encompasses policymakers at federal, state and local levels. The *private sector* includes both not-for-profit and commercial organization policies, such as coverage of prevention by insurers, human resource department policies, employee assistance programs, and other workplace policies and practices. Policy changes in the public sector can influence policies and behaviors in the private sector; conversely, private sector policy change can influence public policy.

To effect policy change, the public health case for addressing cognitive health—the fact that observational evidence and limited short-term clinical trials now exist to support some prevention opportunities in this area—must be made in an easily understandable and consistent manner. National, state and local organizations, agencies and policymakers must be educated about cognitive health and subsequently engaged to help promote positive policy development and change that will increase knowledge and lead to better cognitive health.

Moreover, policy related to maintaining cognitive health does not just address care, behaviors, or risk factors but also promotes resources for building and maintaining community infrastructure that reinforces individual behavior. This could include bike or walking trails to encourage physical activity, community-wide organizations and structures that support healthy behavior, and other changes to the built and cultural

"Developing a road map for cognitive health provides us with an opportunity to reduce health disparities. Some populations are at high risk for cognitive impairment due to high rates of hypertension or diabetes. The Road Map gives us a chance to provide better health information for all Americans, including those at highest risk, so that people may improve their motivation to change their lifestyle for better health outcomes."

Debra Cherry, PhD
Alzheimer's Association

environments that advance the public health goal of cognitive health. Policy initiatives must build upon, relate to, and be compatible with communications and research efforts as they take shape and yield new information.

Communication

The term *communication strategy* implies a multidisciplinary health marketing approach that includes communicating and disseminating scientifically valid information and strategic interventions through customer-centered and culturally appropriate means. A communications strategy for cognitive health aims to educate, motivate, and effect positive behavior change related to cognitive health in targeted and at-risk audiences within 3 years.

To effectively reach this goal, communication messages and methods should:

- Be science based.
- Be geared to populations experiencing the greatest disparities and risks in cognitive health.
- Reach the intended audience and promote action.
- Assist the consumer in making more informed decisions.

The audience of adults aged 42-60 years, also known as baby boomers, belongs to the biggest generation in American history. Cognitive health issues profoundly affect their parents now, and they will touch the boomers in huge numbers as they grow older. It is important to get appropriate valid, evidence-based messages to them, so they may take action for themselves as well as potentially influence their families. Special focus should be given to high risk populations, vulnerable populations and health care providers. Specific racial or ethnic groups (e.g., African Americans, Latinos) may need to have targeted and culturally appropriate materials and tools developed because they may be at greater risk for

experiencing cognitive decline due to higher risks of vascular disease, hypertension and diabetes. Health care providers may have needs and gaps in knowledge that differ from the general public because they are providing information about cognitive health to others. An initial focus on these groups would narrow the scope of effort, affording more achievable outcomes.

In addition, before reaching out to consumers, accurate information and options should be in place throughout the broader medical and social service environment. Health care professionals are the main source of information for many consumers, and past experience has proven the benefits of targeting professional organizations first as peer influencers and trainers of these frontline providers.

Phase 2 — Concept-mapping process

The workgroups collectively proposed 42 recommendations: 18 in prevention research, 8 in communications, 9 in policy, and 7 in surveillance. A concept-mapping process was then used to organize and visually represent them. Concept-mapping combines qualitative and quantitative methods to generate maps that provide a visual representation of the complex relationships among ideas and results.[45] It can elicit ideas from large, diverse, and geographically dispersed groups about a particular topic within a short time frame. Unlike other qualitative methods, concept mapping also provides a structured approach that allows key decision makers to participate in the final interpretation of a larger group's perceptions.

For this project, concept-mapping was organized into three steps.

Step 1 involved reviewing and restructuring recommendations from the workgroups to ensure that each recommendation represented a distinct idea, and identifying the list of stakeholders who would be invited to participate. This list included more than 150 persons from a broad array of institutions, including state and federal agencies, universities, and foundations.

Step 2 consisted of online rating and sorting by invited participants and subsequent analyses of the results.[46] For the rating process, 140 (of the 150) participants were asked to rate both the relative importance of each recommendation and its current action potential. For the sorting task, 20 of these 140 participants were also asked to categorize the recommendations according to their view of similar meanings or themes. Ten (of the 150) participants were invited to

> "I am very impressed with the process because this is a field in which people have strong opinions on many different issues. What impressed me was that the participants in the review process were open to hearing a broad range of opinions but in the end opted for scientific rigor as the guiding feature on which recommendations were based."
>
> Peter Rabins, MD, MPH
> *Coauthor, The 36 Hour Day*

participate in the sorting task only. Because the rating and sorting process was anonymous, exact figures on participation are not available; however, based on the number of total responses, 69 persons (out of 140, or 49.3%) provided input into rating the importance and action potential of each recommendation. Additionally, 23 persons (out of 30, or 76.7%) organized the recommendations into categories to identify themes or patterns. Multivariate statistical techniques were used to organize and visually present results of the online process in a series of concept maps that reflected relationships between recommendations and the clustering of recommendations into categories.

Step 3 encompassed the review and interpretation of the results of Phase 2, and selection of priority recommendations. Members of the Steering Committee reviewed the maps to ensure that the recommendations in each of the eight clusters were consistent with the overall theme of that cluster.

The Committee reconstructed a few recommendations creating two additional recommendations (for a total of 44 recommendations) and in two instances moved recommendations to a different cluster. The final cluster labels are:

- Disseminating information
- Translating knowledge
- Conducting surveillance
- Implementing policy
- Measuring cognitive impairment and burden
- Moving research into practice
- Conducting intervention research
- Developing capacity

As a final step, the Steering Committee chose a set of priority recommendations or actions.

Actions by Cluster

The Road Map is a "living" document expected to evolve over time. Some actions are achievable within 1 to 3 years, while others will require more time to come to fruition. Some are linked and need to occur in a certain sequence, with the outcomes of the first setting the stage for initiating the next. And, while no particular age group is singled out for special attention, the Road Map concentrates primarily on interventions for middle-aged and older adults. This focus recognizes that interventions to reduce risks are best begun early in life; yet, adults, particularly older adults, are more likely to be concerned and motivated to take action.

The full set of Road Map actions fall into eight clusters. Within each cluster, the actions are listed in no special order of priority. The letter in parentheses after each action refers

to the group (either workgroup or Steering Committee) that originally proposed it (P=Prevention Research, C=Communication, P=Policy, S=Surveillance, SC=Steering Committee). All of the actions generated by the groups are included.

In offering these actions, we cannot underestimate the complexities of translating them into action. Most essential is a commitment to base this Road Map on scientific evidence, moving forward collaboratively to leverage existing resources and activities as promotion activities become defined. Key partnerships must be formed among a diverse array of organizations and agencies to build on collective strengths, deliver compatible messages and interventions, and assure efficient use of resources. Existing health promotion communities associated with heart disease, stroke, diabetes, and physical activity are invaluable resources for promoting cognitive health.

Disseminating information

1. **Disseminate the latest science to increase public understanding of cognitive health and to dispel common misconceptions.** (SC)
   Evidence exists that the current boomer generation is concerned about cognitive health and fears Alzheimer's disease. One critical area of focus should be on helping the public to understand the varying levels of evidence behind proposed interventions regarding cognitive health. Unless credible and broad reaching information about valid interventions in cognitive health is disseminated, consumers will fill the gap with untested programs and products. Not only can these programs and products present an economic burden, but some may also distract the aging population from meaningful lifestyle changes. Communications strategies (including the appropriate communication channels) should build upon current efforts by various organizations and agencies to share existing information and materials on cognitive health research and possible interventions that are consistent with current science.

2. **Develop communications strategies and tools to increase awareness among health care providers, public health professionals, and aging service providers at the national, state, and local levels about the current state of science of cognitive health.** (C)
   In disseminating information to the public, information must be filtered through trusted health and community resources. Providing professionals with accurate, evidence-based information and tools will respond to the growing interest among consumers regarding questions on preserving cognitive health.

3. **Develop and implement a training curricula related to cognitive health for continuing professional education of health and human services professionals.** (P)
   To increase the awareness and knowledge of professionals in health and human services, strategies should be developed in both preservice and in-service modalities. Bringing new professionals into the field with appropriate knowledge is not enough; the level of understanding of practicing professionals must also be raised so that they can help the public sort out evidence-based approaches to cognitive health from less proven or undemonstrated outcomes.

4. **Develop creative and replicable means for raising the public's awareness of cognitive health and engaging the public in promoting the importance of cognitive health through policy.** (P)
   The public plays an important role in stimulating both public sector and marketplace action on issues it finds important. It is essential that the public be educated based on current science and knowledge of best practices. This will contribute to the development of a new conventional wisdom regarding cognitive health.

5. **Establish and maintain a Web-based cognitive health clearinghouse, in partnership with stakeholder organizations, that would be recognized as a centralized site for scientifically validated and recognized information.** (C)
   A one-stop-shop, go-to place for valid and tested information will provide consumers and professionals who serve older adults and their families with the tools to make informed decisions about their health and effect positive behavior change. The site would provide guiding principles to help consumers and health information providers and professionals to evaluate local services that address these concerns and to maintain current

understanding about cognitive health and these interventions as the science becomes more sophisticated.

Translating knowledge

1. **Determine how diverse audiences think about cognitive health and its associations with lifestyle factors.** (R)
   It is not clear how the general public or practitioners perceive and understand cognitive health. To develop useful programs, it will be imperative to better understand the diverse target audiences. Some issues that would be important to understand for translation to both the general public and practitioners include: how cognition is defined and translated; what aspects of cognitive health are important (including the level of knowledge about vascular factors); and how concerned the general public is about cognitive health.

2. **Help people understand the connection between risk and protective factors and cognitive health.** (C, SC)
   Risk and protective factors are keys to figuring out how to address individual and community health and require clarifying for the public what is demonstrated as effective in clinical trials versus associations observed in other studies. Of primary interest are aspects of personal and environmental experiences that make it more likely (risk factors) or less likely (protective factors) that people will experience cognitive decline. Consideration should be given to these connections and to promoting a better understanding of it, including an understanding of areas in which clinical trials have (or have not yet) established a cause and effect between risk and protective factors and cognitive health.

3. **Develop a mechanism to review cognitive health messages and programs to determine their scientific accuracy and public credibility.** (C)
   Currently, the public has no single source of informed and valid recommendations for programs, services, and lifestyle related interventions to address positive measures in cognitive health. Creating a system for reviewing the growing number of programs and providing public access to the reviews generated will move consumers closer to informed decisions and more positive investments in health.

Implementing policy

1. **Initiate policy changes at the federal, state, and local levels to promote cognitive health by engaging public officials.** (P)
   Far-reaching public health issues demand informed action by public officials, because action by the private sector alone will be insufficient to reach desired results. Because program and funding decisions are made by policymakers at the national, state and local levels, it is important to engage and educate this audience. Public officials have significant competing interests; it is essential that they become educated and engaged in this arena to contribute to positive policy change in cognitive health interventions and to support the need for further research.

2. **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.** (P)
   The development and use of documents such as *Healthy People 2020* will represent a systematic and widely recognized approach to improving health. As research demonstrates ways in which cognitive health can be

maintained, the area of cognitive health can be elevated to a major health priority by being incorporated into the outcome-oriented approach used by *Healthy People 2020.*

3. **Include the public health burden of cognitive impairment in the *State of Aging and Health in America Report* when population level data are available.** (P)
   Including cognitive health in such documents as the *State of Aging and Health in America Report* would elevate its status as a recognized public health issue and make data readily available for action. Armed with important data from this and other monitoring systems, public health professionals will be prepared to move policy forward to test interventions.

4. **Promote appropriate strategic partnerships among associations, government agencies, insurers and payers, private industry, public organizations, and elected officials to support and advance research and policy related to cognitive health.** (P)
   Partnerships can help to maximize limited resources (fiscal and personnel) and competing priorities. They should be based upon such criteria as the ability to: examine evidence-based research; establish on-going forms of dialogue; build leadership and capacity related to policy and public and professional education; address diverse cultural and ethnic populations; provide funding; and explore the links between the vascular factors, physical activity, and cognitive health.

5. **Engage national organizations and agencies that focus on the older population, and educate these agencies about cognitive health and its connection to their missions.** (P)
   To achieve broad, effective collaborations for cognitive health and emotional well-being, national organizations and agencies must identify and agree to common ground. National organizations and agencies are essential to both reaching large numbers of individual men and women and to using their influence to educate policy makers and opinion leaders. Education of the public and leaders of key organizations is a precursor to policy change related to cognitive health.

6. **Convene policy experts to identify and examine current policies (e.g., national policy, state policy, private sector policy) that could be modified, modernized, or broadened to include cognitive health.** (P)
   Policies should be amended to reflect current science and knowledge and be inclusive of cognitive health. Adjusting and amplifying current policies are efficient and economical routes to systems change.

7. **Promote the modification of existing national and state public health plans to include cognitive health in their strategies or recommendations where appropriate.** (P)
   National and state public health plans significantly influence efforts in public health and serve as a barometer of improvement. As interventions are demonstrated that can have an effect on cognitive health, including it in these plans would elevate its status as a recognized public health issue and provide a venue for the evaluation of progress.

Conducting surveillance

1. **Define the goals of a surveillance system to promote the development of an appropriate system and the collection of data on cognitive health.** (S)
   Clearly defined goals of public health surveillance will promote the development of appropriate surveillance systems and the collection of consistent data that provide useful information to inform public health policy. Goals of the surveillance system may include: defining the burden of cognitive decline in the population; monitoring the trends in burden (e.g., prevalence, incidence); monitoring trends in risk factors; defining the population at increased risk; and determining whether additional analyses should be performed for the purpose of public health surveillance.

2. **Determine which existing general population-based surveillance systems include information useful for the surveillance of cognitive health at national, state and local levels.** (S)
   Adding to or changing existing surveillance systems (e.g., Behavioral Risk Factor Surveillance System, Health and Retirement Study, National Health Interview Survey) to

address issues related to cognitive decline is less costly and may be more efficient than developing new surveillance systems. However, there are important limitations of existing systems and the data they collect; in particular, most are cross sectional rather than longitudinal. Many are already quite lengthy, with major constraints on adding new items. Close examination of these systems will ensure that they are amended appropriately and cost-effectively.

3. **Identify existing studies that measure longitudinal trends in cognitive function.** (S)
   Existing large cohort or other longitudinal studies of cognitive decline may provide items that could be incorporated into surveillance systems for measuring such decline. Some of these studies may have validated items used previously in both majority and minority populations that estimate variability and true change over time.

4. **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.** (S)
   A population-based surveillance system would assist in the collection of consistent data to monitor, assess, and inform public health programs and policy about the public health burden of cognitive impairment.

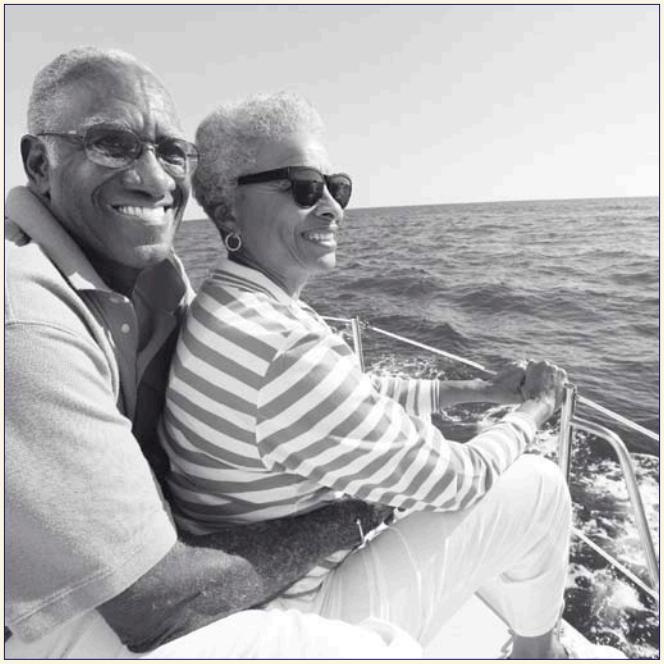
Moving research into practice

1. **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.** (R)
   It is critical to examine all studies to date to document which interventions have been proven effective. Such reviews should focus on determining the relationships between risk factors, protective factors, and cognitive function across observational and clinical trials. Where interventions exist, their effectiveness should be documented and remaining gaps in the field should be identified in order to move strategies into public health practice.

2. **Conduct systematic literature reviews on proposed risk factors (social engagement, nutrition, and mental activity) and related interventions relationships with cognitive health, harms, gaps and effectiveness.** (R, SC)

It is critical to examine all studies to date to document which interventions have been proven effective. Such reviews should focus on determining the relationships between risk factors, protective factors, and cognitive function across observational and clinical trials. Where interventions exist, their effectiveness should be documented and remaining gaps in the field should be identified in order to move strategies into public health practice.

3. **Conduct a systematic literature review on the relationship between treatment of diabetes and cognitive health.** (R)
   Some evidence suggests that diabetes is a risk factor for cognitive decline. Recommendations for types of diabetes management (e.g., medications, lifestyle modification) that might also be beneficial for cognitive health cannot be made without a review of the literature relating diabetes interventions to cognitive change (and most likely undertaking additional clinical trials), and identification of areas that need to be clarified before specific interventions can be proposed.



4. **Conduct a systematic literature review on the relationship between treatment of hypertension and cognitive health.** (R)
   Hypertension is a known risk factor for stroke, and therefore for vascular dementia and cognitive decline. Recommendations for types of antihypertensive therapy and the ranges of blood pressure for different age groups recommended for maintaining cognitive health cannot be made without a review of the literature relating hypertensive interventions to cognitive change, and probably not without pursuing additional clinical trials. The systematic literature review would identify areas that need to be clarified before specific interventions can be recommended.

5. **Identify gaps in knowledge about cognitive health and related lifestyle changes, and determine**

whether these vary by specific groups. (C)
To develop appropriate materials and tools, the gaps in knowledge need to be understood, especially among high-risk populations, vulnerable populations, and health care providers. Specific racial or ethnic groups may need to have targeted and culturally appropriate materials and tools developed because they are at greater risk for experiencing cognitive decline. Health care providers may have needs and gaps in knowledge that differ from the general public because they are also providing information to others about cognitive health.

6. **Conduct a systematic review of lifestyle interventions and contextual factors to examine the benefits and barriers to their adoption and maintenance.** (R)
Understanding the benefits of and barriers to adopting and maintaining an intervention is one of the critical steps for translating interventions effectively and efficaciously in a community-based setting.

7. **Conduct reviews of the literature to determine the prescriptions for physical activity (e.g., type, frequency, duration, and intensity of activity) that are effective in enhancing cognitive function.** (R)
It is important to know what kinds of physical activity stimuli are necessary to promote cognitive health. An examination of the scientific literature will identify gaps in knowledge and focus research. Without such information and research development, accurate advice cannot be conveyed to the public on how active they should be to maintain their cognitive health.

8. **Develop cognitive health interventions that reflect the most current scientific research and that are consistent with effective community-based interventions.** (C,SC)
Clinical trials assessing the efficacy of interventions to effect cognitive function and public health studies examining the effectiveness and feasibility of community-based interventions are often reported separately. More comprehensive approaches involving collaborations between clinical researchers and community participatory researchers are critical to ensure that the effectiveness and feasibility of cognitive health interventions are developed and tested with various communities.

Conducting intervention research

1. **Conduct controlled clinical trials to determine the effect of reducing vascular risk factors on lowering the risk of cognitive decline and improving cognitive function.** (R)
   To date, few vascular studies (including large-scale controlled clinical trials of older adult cohorts) have combined cognitive health outcomes and vascular outcomes in a single study.

2. **Conduct controlled clinical trials to determine the effect of physical activity on reducing the risk of cognitive decline and improving cognitive function.** (R)
   To date, few, if any, physical activity studies (including large-scale controlled clinical trials of older adult cohorts) have combined outcomes for cognitive health and physical activity outcomes in a single study.

3. **Conduct physical activity studies to determine the long-term benefit of physical activity as it relates to cognitive function.** (R)
   To date, studies of physical activity interventions that have assessed cognitive outcomes typically have no follow-up at all or only a short follow-up. Studies of physical activity are needed to determine to what extent any cognitive benefits associated with physical activity persist across long-term follow-up: at 6 month, 1 year, or longer time periods. Long-term follow-up studies of physical activity are also needed to determine the duration of cognitive effects in those who stop the program.

4. **Conduct studies to determine the physical activity prescription (e.g., type of activity, frequency, duration, and intensity) needed to maintain or promote cognitive functioning.** (R)
   Small clinical trials have shown that aerobic activity (e.g., walking several times a week for 6 months duration) was capable of producing cognitive improvement in older adults, at least in the short term. These few studies, however, have yet to yield a "prescription" that could be given to older adults; thus, many questions remain to be answered about the types of activity (e.g., aerobic or anaerobic, individual or group) and their duration, intensity, and frequency that are needed to maintain, or even gain, good cognitive function.

5. **Conduct studies to determine the effect of physical activity and physical activity relapse on persons of**

different backgrounds in relation to cognition. (R)
Similar to the pharmacogenetics approach that has been used to determine the efficacy of specific drugs for persons with certain genotypes, it seems possible that recommendations for behavioral interventions such as physical activity might be crafted to an individual person's background (e.g., genetic endowment, cultural context, life histories, fitness levels, and age).

6. **Identify how physical activity relates to those aspects of cognitive functioning that are important to the successful performance of activities of daily living and instrumental activities of daily living.** (R)
It is important to understand how any cognitive benefit measured in the laboratory translates to better functioning in real world tasks. Although well-controlled laboratory studies are essential to advancing knowledge in this area, it is currently not clear how much the cognitive tasks assessed in these studies will generalize to the cognitive functioning required in routine daily activities important to older adults, such as balancing a check book, safely driving a car, and compliance with prescriptions for medications (i.e., knowing how many or what pills to take when).

7. **Determine the feasibility of conducting secondary analyses of existing studies to examine the relationship between physical activity and the maintenance of cognition.** (R)
It is recognized that secondary analyses of existing data sets often possess methodological problems (including cross sectional data). Nevertheless, data sets (perhaps even some representative of the U.S. population) may exist that contain variables related to cognitive functioning, health, and physical activity. Efforts to locate such data and to evaluate research questions and associations among the variables may provide additional insights into this area.

8. **Identify the mechanisms that may mediate the relationship between physical activity and cognitive functioning.** (R)
Physical activity may not affect cognitive function directly but it may still affect it through intermediate mechanisms. It is important to know whether the association between physical activity and cognitive functioning is mediated by changes in diabetes outcomes, in vascular fitness outcomes, or in risk factors such as hypertension or hyperlipidemia.

9. **Encourage cardiovascular disease and diabetes researchers to use appropriate measures addressing cognitive domains as outcomes in their studies.** (R)
   The best way to understand which interventions in cardiovascular disease and diabetes will affect cognitive health is for appropriate aspects of cognitive measures to be routinely included in appropriate studies in these two areas.

10. **Encourage research to determine the impact of multiple vascular risks on cognition.** (R)
    Specific focus is needed to both understand the biology of how vascular risk factors affect cognition and to determine whether the effects of having multiple factors are additive or multiplicative. Some observational studies have suggested that the greater the number of vascular risk factors, the greater the cognitive deficit. We know, however, that clinical trials with pharmacological agents that control individual risk factors have effectively reduced vascular risk but have not consistently produced cognitive benefit. A better understanding of the mechanisms by which multiple vascular risk factors may contribute to cognitive deficits could identify targets for interventions to reverse or reduce the deficit. The biological mechanisms of the interaction among risk factors, as well as models of the size of the interaction effect on cognition, would assist in designing trials of potentially effective interventions.

11. **Conduct research on other areas potentially affecting cognitive health such as nutrition, mental activity, and social engagement.** (R)
    Science is evolving regarding risk and protective factors in the areas of cognitive training, nutrition, and social engagement. It is critical to monitor and include these areas as the science emerges.

Measuring cognitive impairment and burden

1. **Identify thresholds for cognitive decline that have functional importance for population-based surveillance systems.** (S)
   It is important to recognize points on the continuum of cognitive decline that are functionally meaningful. It should also be recognized that measurements beyond some points on this continuum may require information from proxy respondents. Useful comparisons of findings from different surveillance systems and research studies are improved if there is consistency among the thresholds being used. Functionally important thresholds should be of practical significance to help inform public health policy regarding needs for caregiver support and other special health care or social services.

2. **Identify critical dimensions of cognition and the most appropriate corresponding measures that may be useful in surveillance systems.** (S)
   It is important to know the key components of cognition (e.g. memory, intelligence, problem solving, and reasoning) that are most sensitive and specific to cognitive decline and practically measurable in surveillance systems. Useful, measurable components are expected to differ according to the nature of the surveillance system, particularly whether data collection is longitudinal or cross-sectional. With cross sectional data alone, fewer inferences are possible regarding age-related cognitive decline.

3. **Identify measures of the public health burden of cognitive impairment on individual people, families, and communities.** (SC)
   The public health burden of cognitive impairment encompasses its effects on individual men and women, caregivers, families, employers, and others in the community. These effects may have physical, mental, social, and economic dimensions. It is important to identify key measurable components of these effects to enable the public health burden to be fully assessed, monitored, and described.

4. **Identify a set of questions appropriate for use in people of diverse educational attainment, culture, and ethnicity that will measure cognitive function with sufficient sensitivity, specificity, and predictive values.** (S)

These questions might exist within an ongoing population-based surveillance system, or they could be added to such a system. To the extent possible, education- and culture-independent measures should be sought. Because the effects of education and culture are potential confounders, measures and analytic techniques are needed that would enable reduced cognitive function to be distinguished from low performance due to variations in educational or cultural exposures. It is critical to recognize and correct these confounding effects so as to avoid misinterpreting or misusing surveillance data.

Developing capacity

1. **Engage the private sector and other entities in planning and funding research to address ways to maintain and improve cognitive health, including clinical trials.** (R)
   Support of research on cognitive health is expensive in scope, effort, and cost. Partnerships with federal agencies, foundations, and other entities will likely be necessary to secure such support and conduct this research.

2. **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.** (R)
   The fields of cardiovascular disease, depression, diabetes, and cognition are beginning to intersect. After conducting literature reviews on what is currently known about the effects of interventions targeting vascular factors, depression, and diabetes on cognitive health, researchers and community interventionists in each of these fields should be convened to determine strategies for moving the field of cognitive health forward.

Next Steps

Priorities for action

While we believe that all of the actions presented in this Road Map are important, we are mindful of the limited pool of resources with which to implement them. Because of this reality, we selected 10 actions of highest priority for immediate attention.

- **Determine how diverse audiences think about cognitive health and its associations with lifestyle factors.**

  It is not clear how the general public or practitioners perceive and understand cognitive health. To develop useful programs, it will be imperative to better understand the diverse target audiences. Some issues that would be important to understand for translation to both the general public and practitioners include: how cognition is defined and translated; what aspects of cognitive health are important (including the level of knowledge about vascular factors); and how concerned the general public is about cognitive health.

- **Disseminate the latest science to increase public understanding of cognitive health and to dispel common misconceptions.**

  Evidence exists that the current boomer generation is concerned about cognitive health and fears Alzheimer's disease. One critical area of focus should be on helping the public to understand the varying levels of evidence behind proposed interventions regarding cognitive health. Unless credible and broad reaching information about valid interventions in cognitive health is disseminated, consumers will fill the gap with untested programs and products. Not only can these programs and products present an economic burden, but some may also distract the aging population from meaningful lifestyle changes. Communications strategies (including the appropriate communication channels) should build upon current efforts by various organizations and agencies to share existing information and materials on cognitive health research and possible interventions that are consistent with current science.

- **Help people understand the connection between risk and protective factors and cognitive health.**

  Risk and protective factors are keys to figuring out how to address individual and community health and require clarifying for the public what is demonstrated as effective in clinical trials versus associations observed in other studies. Of primary interest are aspects of personal and environmental experiences that make it more likely (risk factors) or less likely (protective factors) that people will experience cognitive decline. Consideration should be given to these connections and to promoting a better understanding of it, including an understanding of areas in which clinical trials

have (or have not yet) established a cause and effect 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.**

  It is critical to examine all studies to date to document which interventions have been proven effective. Such reviews should focus on determining the relationships between risk factors, protective factors, and cognitive function across observational and clinical trials. Where interventions exist, their effectiveness should be documented and remaining gaps in the field should be identified in order to move strategies into public health practice.

- **Conduct controlled clinical trials to determine the effect of reducing vascular risk factors on lowering the risk of cognitive decline and improving cognitive function.**

  To date, few vascular studies (including large-scale controlled clinical trials of older adult cohorts) have combined cognitive health outcomes and vascular outcomes in a single study.

- **Conduct controlled clinical trials to determine the effect of physical activity on reducing the risk of cognitive decline and improving cognitive function.**

  To date, few, if any, physical activity studies (including large-scale controlled clinical trials of older adult cohorts) have combined outcomes for cognitive health and physical activity outcomes in a single study.

- **Conduct research on other areas potentially affecting cognitive health such as nutrition, mental activity, and social engagement.**

  Science is evolving regarding risk and protective factors in the areas of cognitive training, nutrition, and social engagement. It is critical to monitor and include these areas as the science emerges.

- **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.**

  A population-based surveillance system would assist in the collection of consistent data to monitor, assess, and inform

public health programs and policy about the public health burden of cognitive impairment.

- **Initiate policy changes at the federal, state, and local levels to promote cognitive health by engaging public officials.**

  Far-reaching public health issues demand informed action by public officials, because action by the private sector alone will be insufficient to reach desired results. Because program and funding decisions are made by policymakers at the national, state, and local levels, it is important to engage and educate this audience. Public officials have significant competing interests; it is essential that they become educated and engaged in this arena to contribute to positive policy change in cognitive health interventions and to support the need for further research.

- **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.**

  The development and use of documents such as *Healthy People 2020* will represent a systematic and widely recognized approach to improving health. As research demonstrates ways in which cognitive health can be maintained, the area of cognitive health can be elevated to a major health priority by being incorporated into the outcome-oriented approach used by *Healthy People 2020.*

These priorities cut across the clusters and, as a package, would put our "best foot forward" in meeting the public health challenges of cognitive health. The priority actions put forth represent the best thinking of leading experts across diverse fields of influence. They have been identified as ones that are necessary to moving the issue of cognitive health into public health practice. We urge the nation to adopt these 10 actions and to join forces in implementing them over the next 3-5 years. Doing so would be making tremendous strides towards achieving our long-term vision: maintaining or improving the cognitive performance of all adults.

Implementation

Effective implementation of the actions outlined in this Road Map hinges on several factors.

- Organizations will need to identify clearly which actions they wish to address, and collaborate with other groups that share an interest in those actions.
- Organizations should develop and strengthen partnerships with other like-minded organizations.
- Organizations should develop their own plans to achieve their selected actions.
- Organizations should establish systems to track their progress towards completing their plans of action and to facilitate communication and exchange of information.

As the science of cognitive health is continually evolving, the Road Map should be viewed as a living document that contains a wide range of actions on how to proceed. As we achieve some of the actions, we can use the Road Map to move forward and address other actions that become relevant and feasible.

Conclusion

This Road Map comes at a critical time when scientific interest in cognitive health is beginning to meet the burgeoning demand of the public for ways to maintain cognitive function. It sets in motion a course of action for establishing partnerships, making cognitive health a prominent public health issue, and preparing society for concerted efforts to maintaining the cognitive health of older Americans.

The Road Map is 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, and working collaboratively to move the evidence about maintaining cognitive health into national action.

Appendix A: Contributors

Communications Workgroup

Mary Guerriero Austrom, PhD
Indiana Alzheimer's Research Center
Indiana University School of Medicine

Frank Bailey, JD
AARP

Diane Bazelides
Alzheimer's Association National Board

Vicky Cahan
National Institutes of Health

Nancy Ceridwyn
American Society on Aging

Martha DiSario
Pacific Communications Enterprises

Barbara E. Gill, MBA
The Dana Foundation
The Dana Alliance for Brain Initiatives

Jeff McKenna
Centers for Disease Control and Prevention

Michael C. Patterson
AARP

Delores Pluto, PhD
University of South Carolina

Mary Schwartz, MS
Alzheimer's Association

Bob Rosenblatt
National Academy of Social Insurance

Policy Workgroup

William F. Benson
Health Benefits ABC's

Joy Cameron
National Governors Association

Iris Freeman
Advocacy Strategy

Kathryn Gallagher
Centers for Disease Control and Prevention

Robyn Golden, LCSW
Rush University Medical Center

Catherine Gordon, R.N, MBA
Centers for Disease Control and Prevention

Mary Guthrie
Administration on Aging

David Hoffman, MEd
New York State Department of Health

Jim Howard
California Department of Health Services

Debra Lappin, JD
B&D Consulting LLC

Stephen McConnell, PhD
Alzheimer's Association

Sandy Markwood
National Association for Area Agencies on Aging

Mark Schoeberl
American Heart Association

Paul Tibbits Jr.
American Diabetes Association

Prevention Research Workgroup

Marilyn Albert, PhD
Johns Hopkins Medical Institutions

Margaret Gatz, PhD
University of Southern California

J. Neil Henderson, PhD
University of Oklahoma Health Sciences Center

Kathryn Jedrziewski, PhD
Institute on Aging
University of Pennsylvania

Rhonda Montgomery, PhD
University of Wisconsin - Milwaukee

Marcelle Morrison-Bogorad, PhD
National Institute on Aging

Peter Rabins, MD, MPH
Johns Hopkins University School of Medicine

Mary Sano, PhD
Alzheimer's Disease Research Center
Mount Sinai School of Medicine

Jesus Soares, MSc, ScD
Emory University
Centers for Disease Control and Prevention

William Thies, PhD
Alzheimer's Association

Barbara Vickrey, MD, MPH
University of California at Los Angeles

Molly Wagster, PhD
National Institute on Aging

Nancy Whitelaw, PhD
National Council On Aging

Sheree Marshall Williams, PhD, MSc
Centers for Disease Control and Prevention

Kristine Yaffe, MD
University of California, San Francisco
San Francisco Veteran's Administration
Medical Center

Surveillance Workgroup

Dallas Anderson, PhD
National Institute of Aging

Hugh C. Hendrie, MB, ChB, DSc
Indiana University Center for Aging Research
Regenstrief Institute, Inc.

Walter "Bud" Kukull, PhD
University of Washington

James N. Laditka, DA, PhD, MPA
University of South Carolina

Kenneth M. Langa, MD, PhD
University of Michigan

Eric B. Larson, MD, MPH
Group Health Center for Health Studies

Lenore Launer, PhD
National Institute on Aging

Lisa C. McGuire, PhD
Centers for Disease Control and Prevention

Dan Mungas, PhD
University of California, Davis

Nathalie de Rekeneire, MD, MS
Centers for Disease Control and Prevention

Paul Scherr, PhD, DSc
Centers for Disease Control and Prevention

David Thurman, MD
Centers for Disease Control and Prevention

Appendix A: Contributors

Additional Contributors

A very special thank you to all of the men and women who provided feedback on the recommendations.

Robert Blancato, MPA
Matz, Blancato & Associates, Inc

Amy R. Borenstein, PhD
University of South Florida

John C. S. Breitner, MD, MPH
University of Washington

Carol Bryant, PhD
University of South Florida

Carl Caspersen, PhD
Centers for Disease Control and Prevention

Wojtek Chodzko-Zajko, PhD
University of Illinois at Urbana-Champaign

James Cooper, MD
George Washington University School of Medicine

Carl Cotman, PhD
Institute for Brain Aging and Dementia
University of California at Irvine

Rod Dishman, PhD
University of Georgia

Charles F. Emery, PhD
Ohio State University

Paul Estabrooks, PhD
Kaiser Permanente-Colorado

Jennifer L. Etnier, PhD
University of North Carolina at Greensboro

Denis A. Evans, MD
Rush Institute for Healthy Aging
Rush University

Jeff Finn
American Society on Aging

Patrick Fox, PhD
Institute for Health & Aging
University of California at San Francisco

Mary Ganguli, MD, MPH
University of Pittsburgh School of Medicine

Francine Grodstein, ScD
Harvard Medical School

Bradley D. Hatfield, PhD
University of Maryland

Michael Johnson
*OB*C Group, LLC*

Arthur Kramer, PhD
Beckman Institute
University of Illinois at Urbana-Champaign

Darwin Labarthe, MD, MPH, PhD
Centers for Disease Control and Prevention

Michael W. Link, PhD
Centers for Disease Control and Prevention

Nancy B. Emerson Lombardo, PhD
Boston University School of Medicine

Edward McAuley, PhD
University of Illinois at Urbana-Champaign

Guy McKhann, MD
The Zanvyl Krieger Mind/Brain Institute
Johns Hopkins University

Toni P. Miles, MD, PhD
University of Louisville

Mark Moss, PhD
Boston University School of Medicine

Marcia Ory, PhD, MPH
The Texas A&M University System Health Science Center

Ronald C. Petersen, PhD, MD
Mayo Clinic College of Medicine

Scott L. Parkin
National Council on Aging

Tom Prohaska, PhD
The Center for Research on Health and Aging Research and Policy Centers
University of Illinois at Chicago

Stephanie Ramsey
Centers for Disease Control and Prevention

George W. Rebok, PhD
Johns Hopkins University

Walter A. Rocca, MD, MPH
Mayo Clinic College of Medicine

Ken Rockwood, MD, FRCPC
Dalhousie University

Gail Shearer
Consumers Union

Phillip D. Tomporowski, Ph.D.
University of Georgia

Terrie Fox Wetle, PhD
Brown University

Peter Zandi, PhD, MPH, MHS
Johns Hopkins University

Staff

Lindsay Abraham, MPH
Northrop Grumman/
Centers for Disease Control and Prevention

Mark Conner
Northrop Grumman/
Centers for Disease Control and Prevention

Kristine L. Day, MPH
Centers for Disease Control and Prevention

Sheila Jack, MUP, MSJ
Alzheimer's Association

Brenda Pepe
Concept Systems, Inc.

Peter Reed, PhD, MPH
Alzheimer's Association

Walker Tisdale, MPH
Alzheimer's Association

Susan Toal, MPH
Public Health Writer/Editor

Catherine VanBrunschot
Concept Systems, Inc.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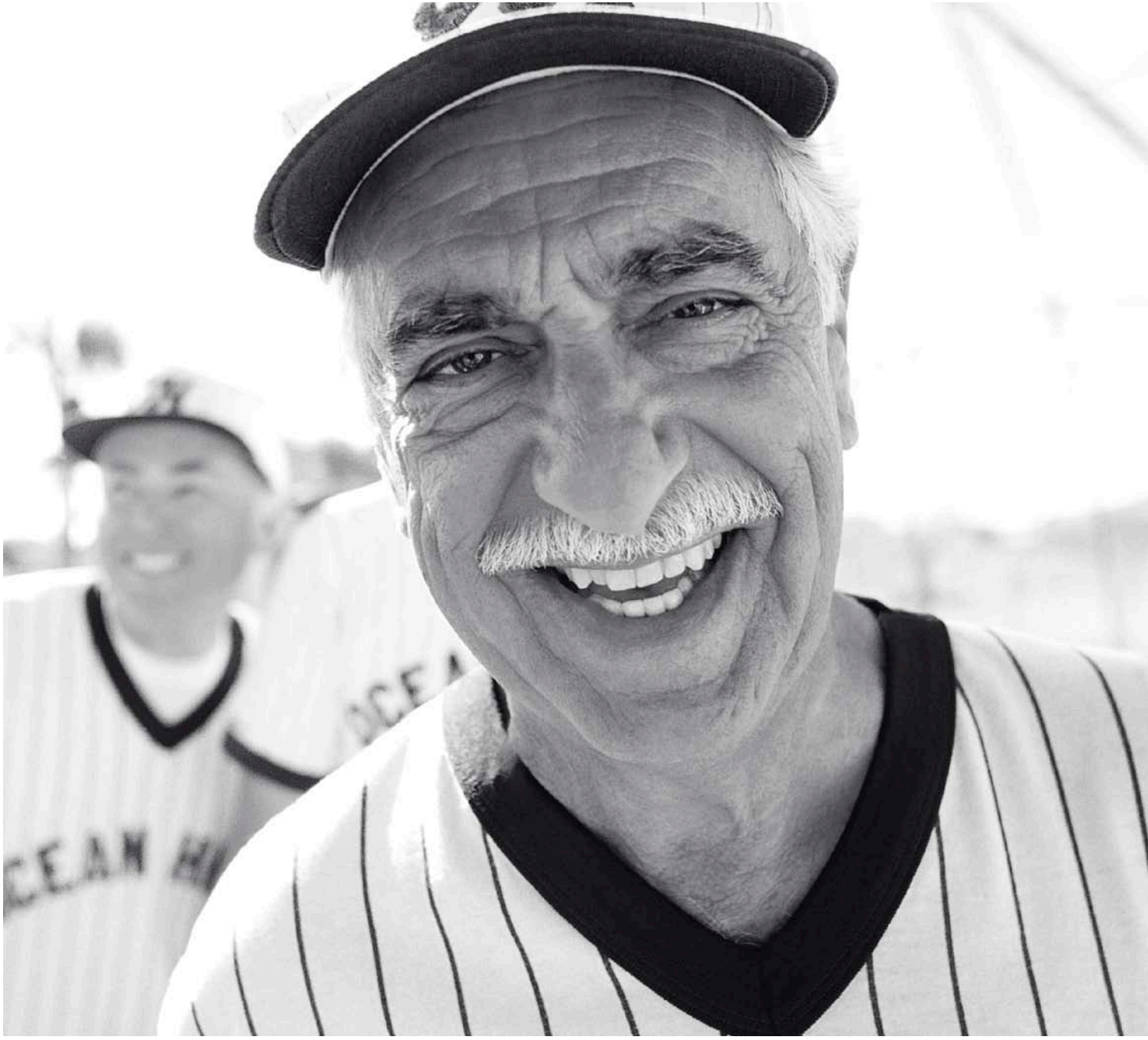

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