SPECIAL ARTICLE

The Brain Health Imperative in the 21st Century—A Call to Action

The AAN Brain Health Platform and Position Statement

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Abstract

Brain health is crucial to optimizing both the function and well-being of every person at each stage of life and is key to both individual and social progress. As a concept, brain health is complex and requires a multidisciplinary collaborative approach between many professional and public organizations to bring into effect meaningful change. Neurologists are uniquely positioned to serve as specialists in brain health and to advance the newly evolving field of preventive neurology, which aims to identify individuals at high risk of brain disorders and other neurologic conditions and offer strategies to mitigate disease emergence or progression. For decades, the American Academy of Neurology (AAN) has demonstrated a commitment to brain health through its public outreach and advocacy. The AAN's Brain Health Initiative launched in 2022 with a strategic plan prioritizing brain health as a key aspect of public engagement and positioning the AAN and neurologists as champions of brain health in collaboration with a broad range of other brain health providers. In this study, we present (1) the new definition of brain health developed by the AAN for neurologists, patients, partners in health care, and the public; (2) the strategic objectives of the AAN Brain Health Initiative; and (3) the AAN Brain Health Platform and Action Plan framework, including key positions on brain health, its 3 ambitious goals, and a national brain health vision. The top-line priorities of the AAN Brain Health Action Plan highlight the need for research, education, public policy, and direct-to-public messaging across the individual's life span and will serve as a catalyst for future cross-disciplinary collaborations within each epoch and longitudinally. The AAN Brain Health Platform is designed to communicate the AAN's vision for brain health and provide a blueprint toward achieving the future of optimal brain health across the life span for all. Through this position statement, we call upon neurologists and other stakeholders in brain health to join our collective efforts to accomplish the ultimate goal of transforming the current trajectory of public health of an increasing burden of neurologic disorders—from both illness and injury—to achieving optimal brain health for all.

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Glossary

COPE = Committee on Public Engagement; **AAN** = American Academy of Neurology.

Introduction

For more than a century, the field of neurology has propelled advances in the diagnosis and treatment of disorders of the nervous system and, specifically, the brain as its command-and-control center. While this crucial work continues at an unprecedented pace, the future of neurology is increasingly grounded in data-driven preventive strategies for achieving and maintaining optimal brain health across the life span. Whereas the definition of "optimal" may vary based on every individual's state of overall health and life stage, our assumption here is that every individual aspires to achieve their unique optimal state of health. Furthermore, optimal brain health is fundamental to function and well-being at each life stage and is critical to individual and societal progress. Therefore, the advancement of brain health is central to public health.

Elements of brain health have been extensively highlighted in the recent years, including public and professional promotion of vascular brain health[1] and healthy aging[2] through education along with establishing initial recommendations for primary prevention of stroke and dementia.[3] As another key element of brain health, mental health has been championed in public campaigns promoting awareness and action in support of brain health research.[4] Neuroscientists are joining forces worldwide to catalyze and share knowledge about the brain "for the benefit of humanity."[5-7] The increasing number of recent local, national, and global brain health initiatives, notably by the Centers for Disease Control and the World Health Organization,[8-12] have fostered an understanding of brain health as an evolving concept[13,14] whose forward progress requires collaboration between the public at large, community advocates, patients, scientists, and health practitioners to bring into effect meaningful change in research, advocacy, and public engagement.

Stand-alone brain health centers and initiatives have proliferated across the United States and the world, although they lack much-needed recognition and synergy to strategically promote and advance brain health on a large scale. No single medical or allied profession has been able to develop and implement a comprehensive life-span strategy for brain health that transcends its elements (such as vascular, cognitive, and mental health or those related to brain development and maturation).

Conceptually, brain health is complex and reflects elements of the brain structure and function affected by neurologic, biomedical, psychological, socioeconomic, and environmental factors across the life span.[15] This expansive and multifaceted construct demands a unified, structured approach by professionals trained to promote, maintain, and support neurologic health. Neurologists are uniquely qualified to effectively safeguard the health of the nervous system as a strategy to alleviate the burden of neurologic disorders. Supported by the American Academy of Neurology (AAN) and in collaboration with other stakeholders, neurologists can spearhead the efforts to convene brain health experts and align initiatives across medical subspecialties and allied professions engaged in brain health.

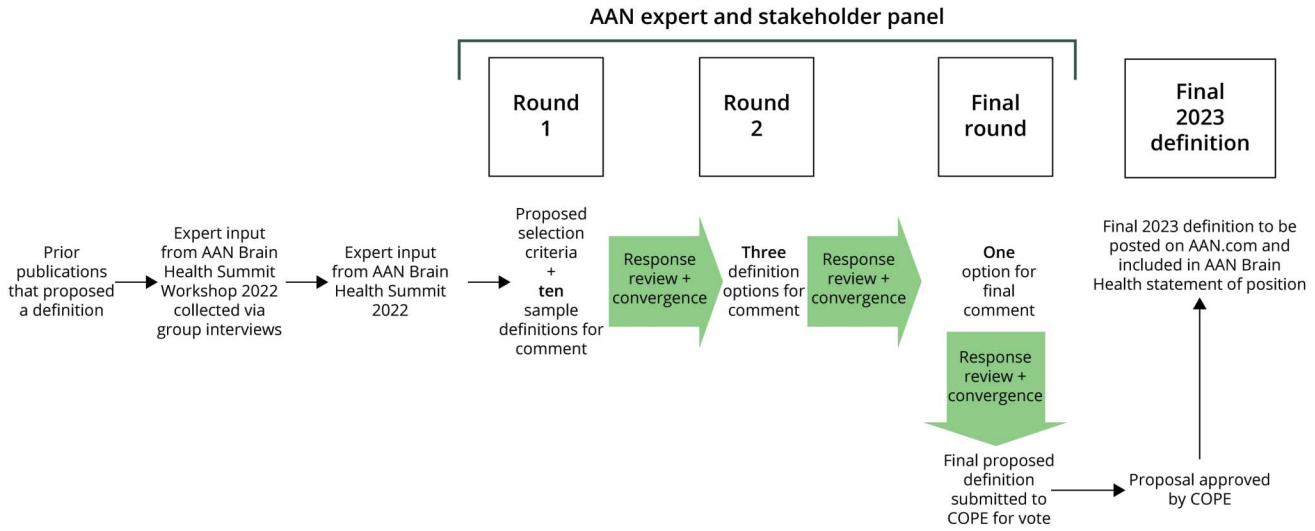
Defining Brain Health

The AAN definition of brain health was informed by numerous prior publications[1,3,4,13,15-18] that have outlined various elements (i.e., cognitive, mental, emotional, physical, psychosocial) and determinants (i.e., nutrition, sleep, exercise, environmental safety) of brain health. Definitions such as the ones proposed by the American Heart Association/American Stroke Association[1] and the World Federation of Neurology[19] addressed key elements (i.e., cognitive domains and their role in daily function) and determinants[3] (i.e., behavioral, environmental, and metabolic risk factors) with a particular emphasis on the neurovascular unit. Various organizations[17] have provided guidance around the importance of an ideal definition facilitating measurable outcomes for future research while also reviewing the various strengths and limitations of proposed definitions in relation to promoting health, well-being, and productivity.[15]

To develop the AAN's definition of brain health for neurologists, patients, partners in health care, and general public, members of the AAN's Committee on Public Engagement (COPE), and a group of physician leaders with expertise relevant to each life stage—including members of the AAN Brain Health Initiative Work Groups as well as members of the AAN Board of Directors and Committee Chairs—were invited to participate as part of an expert panel (Appendix). The process followed a modified Delphi method[20] to establish a thoughtful pluralistic consensus among important internal stakeholders to the AAN and its Brain Health Initiative. In brief, after collecting expert input from the AAN Brain Health Summit Workshop in April 2022 by 4 rounds of focus group interviews and further expert input at the AAN Brain Health Summit in September 2022, the modified Delphi process consisted of 2 iterative rounds of online surveys that built up to a third and final round that yielded the proposed definition based on evidence and expert opinion (Figure 1). The process included an initial opportunity to identify group consensus around guiding principles that were viewed as most critical to defining brain health, followed by 3 opportunities to provide feedback between rounds (Appendix).

This collaborative process resulted in the following 2023 AAN definition of brain health:

Figure 1 Flow Diagram of the Process to Develop a Consensus-Driven Definition for Brain Health



> Brain health is a continuous state of attaining and maintaining the optimal neurologic function that best supports one's physical, mental, and social well-being through every stage of life.

While brain health may be defined in many ways, we sought to develop a definition that accurately represents the values of the AAN membership and that will serve the public and other stakeholders across the life span. Of note, the proposed definition was developed with an emphasis on highlighting specific elements that were consistently endorsed as important by the expert panel: (1) that the definition be as inclusive as possible to all individuals; (2) that the definition be aspirational in nature while also highlighting the importance of the concepts of prevention and preservation in health; (3) that the definition not be overly prescriptive, especially given that the field and the initiative are currently evolving; (4) that the definition be as unique to neurology as possible; (5) that the definition highlights that brain health is a concept that continuously stretches across the entire life span; and (6) that brain health encompasses key subdomains of well-being, specifically physical, mental, and social well-being. Nevertheless, as the brain health concept continues to rapidly evolve and grow in complexity, we will seek additional input and engage in subsequent revisions with the overall AAN membership and the broad coalition of stakeholders convened by the AAN.

The Era of Preventive Neurology Has Arrived

Neurologists are uniquely positioned to advance brain health through the emerging field of preventive neurology, which offers management strategies that either prevent or mitigate neurologic disease onset and progression.[21] After decades of practice advances in evaluation and management of neurologic diseases, the era of preventive neurology—a cross-disciplinary field that focuses on diagnostic, treatment, and nonpharmacologic intervention strategies that offset the development and progression of neurologic diseases—has arrived. Preventive neurology requires a collaborative and proactive approach across medical subspecialties—especially community-based general practitioners including pediatricians and geriatricians, nonmedical professionals, community and industry stakeholders, and policymakers on national and global levels. Neurologists are poised and eager to convene this expansive community of stakeholders, leading a unified approach with sound evidence and a patient and community-centered focus.

The growing burden of neurologic disorders on patients, caregivers, and society worldwide requires a comprehensive, effective, and enduring strategy for prevention—above and beyond those measures that are currently necessary to optimally diagnose and treat brain disease. According to a 2017 study, nearly $800 billion per year of the US economy is spent on the 9 most prevalent and costly neurologic disorders,[22] whereas a 2016 study published by the Information Technology and Innovation Foundation reported that the cost of brain health conditions (neurologic and mental disorders combined) is upwards of $1.5 trillion per year in the United States.[23] Both figures likely underestimate the current effect of neurologic and mental illness in the post-COVID era.

By defining and advancing the concept of brain health, the AAN is developing a strategy to leverage preventive measures on individual, community, national, and global levels across the life span. Along with diagnostic and management breakthroughs in this area, this approach necessitates novel professional education strategies, including universal and disease-selective prevention training, cross-disciplinary engagement, and expansion of public health efforts.[23]

The AAN Brain Health Initiative

For decades, the AAN has demonstrated a commitment to brain health through its public outreach, including the highly successful *Brain & Life* magazine, website, and podcast; Brain Health Fairs to promote public awareness of brain health and

Figure 2 The American Academy of Neurology's Brain Health Initiative Strategic Objectives

1	Formalize a definition of brain health as a neurologic concept
2	Characterize multiple components of brain health from the angle of multiple and often coexisting pathologies that may affect optimal health across an individual's life course
3	Assess the current scope of science supporting the broad concept of brain health and determine knowledge gaps and future research directions
4	Develop and disseminate neuroscience-supported preventive care guidelines for brain health
5	Communicate the value of brain health and the role of neurologists in supporting it to patients, communities, stakeholders, research funding agencies, and other medical and allied professionals
6	Position the AAN and neurologists as champions of brain health in collaboration with a broad range of other brain health providers

neurologic disease; and a multitude of advocacy and educational activities that have supported and promoted the concept of neurologic health and preventive neurology. After being established in 2021, COPE presented a strategic plan prioritizing brain health as a key aspect of public engagement, effectively spearheading the AAN's Brain Health Initiative.

The strategic objectives of the AAN Brain Health Initiative are (1) to formalize a definition of brain health as a neurologic concept; (2) to characterize multiple components of brain health from the angle of multiple and often coexisting pathologies that may affect optimal health across an individual's life course; (3) to assess the current scope of science supporting the broad concept of brain health and to determine knowledge gaps and future research directions; (4) to develop and disseminate neuroscience-supported preventive care guidelines for brain health; (5) to communicate the value of brain health and the role of neurologists in supporting it to patients, communities, stakeholders, research funding agencies, and other medical and allied professionals; and (6) to position the AAN and neurologists as champions of brain health in collaboration with the broad range of other brain health providers (Figure 2).

This initiative has short, intermediate, and long-term goals. In the short term, the AAN will serve as a convener to synchronize, optimize, and organize the field of brain health and its stakeholders to better define and advance the concept of brain health for the benefit of the public and patients with neurologic disorders. In the intermediate term, supported by the AAN, neurologists will serve as the primary source of trusted information on brain health for patients and the public, including policymakers. In the long term, building on established collaborations, neurologists will work to optimize brain health along the life course of individuals and within communities, including developing the concept of primary care for the brain, actively providing brain health care, and promoting brain health education and research as part of a preventive neurologic care strategy.

As a first step toward achieving the short-term goals of the Brain Health Initiative, the inaugural AAN Brain Health Summit was convened on September 15, 2022, in Washington, DC, with the objective of introducing an enduring framework of cross-disciplinary collaborations to enhance brain health through scientific discovery, public policy, development of patient and professional education, and broad dissemination of trustworthy brain health information relevant across the entire life span. In conjunction with the summit, September 15, 2022, was introduced as "National Brain Health Day" by a joint US congressional resolution on that day.[24]

The AAN Brain Health Summit was designed as an open forum for 100 brain health experts from medical and allied fields[25] as well as a broad range of external stakeholders to set forth critical priorities for public engagement, scientific research, public policy, and standards of practice in the field of brain health. Significant portions of the summit were dedicated to expert comment on the AAN's proposed vision and strategy to advance and promote individual and population brain health. Crucial to the success of the event was the generous participation of the National Institute on Aging, the Healthy Brains Global Initiative, the University of Texas at Dallas Center for Brain Health, the American Heart Association, the Institute of Health Metrics and Evaluation, the Global Brain Health Institute, the Centers for Medicare & Medicaid Services, and AARP, among others, who were represented at the summit and shared their work in brain health. A highlight of the event was an appearance by US Senator Ben Ray Luján of New Mexico, a recent stroke survivor, who shared his personal health experience and expressed his ongoing commitment to brain health. The AAN Brain Health Summit will continue to advance the AAN Brain Health Initiative, with the vision of convening stakeholders annually to share the progress on its short, medium, and long-term goals. The second Brain Health Summit will take place on Thursday, September 21, 2023, in Washington, DC.

Figure 3 The American Academy of Neurology's Brain Health Platform

AAN's positions on brain health

1	Brain health is key to neurologic health and a core function of neurology
2	Brain health is foundational to the overall health of communities throughout the United States and worldwide
3	Brain health requires collaboration between the many disciplines that share a mission to promote the prevention of neurologic diseases, optimal mental health, and well-being of individuals across the life span

AAN's brain health goals

1	Accelerate scientific discovery in brain health through cross-disciplinary collaboration
2	Optimize brain health through integration of preventive care practices
3	Enhance public and patient engagement to advance public policy in brain health

AAN national brain health vision by 2050

1	Brain health research leads to an accumulation of a critical body of knowledge and scientific breakthroughs
2	Preventive neurology is a thriving cross-disciplinary field that develops new leaders in brain health
3	Evidence-based practice guidelines on brain health for all ages are available and continuously updated
4	A "brain health visit" is a standard of care and part of a "well visit" at every stage across the life span
5	Education on brain health across the life span is widely available and results in a highly aware and engaged public
6	National Brain Health Plan is established to guide scientific research, care, and public engagement priorities

The AAN Brain Health Platform and Action Plan Framework

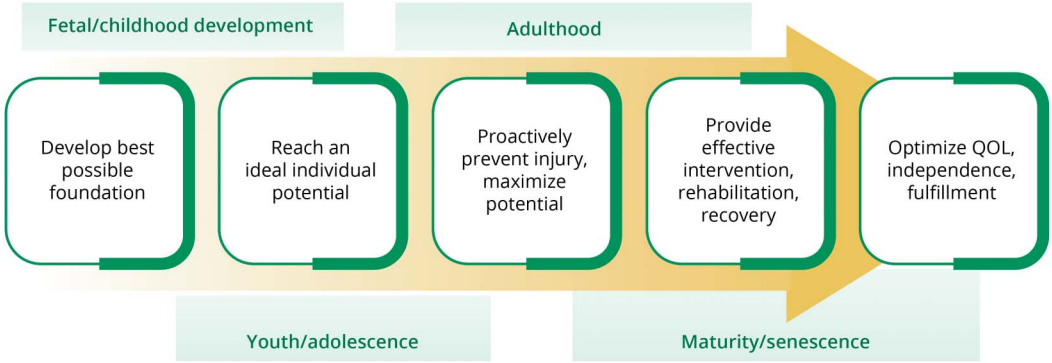
In consideration of its mission to promote the highest quality patient-centered neurologic care and in support of its vision to be indispensable to its members, the AAN declares the following positions:

1. Brain health is key to neurologic health and a core function of neurology.
2. Brain health is foundational to the overall health of communities throughout the United States and worldwide.
3. Brain health requires collaboration between the many disciplines that share a mission to promote prevention of neurologic diseases, optimal mental health, and well-being of individuals across the life span.

These positions constitute a key framework of the AAN Brain Health Platform, which is designed to communicate the vision and to provide a blueprint toward achieving the future of optimal brain health across the life span for all. The AAN Brain Health Platform supports stakeholders in brain health through its 3 ambitious goals to (1) accelerate scientific discovery in brain health through cross-disciplinary collaboration, (2) optimize brain health through integration of preventive care practices, and (3) enhance public and patient engagement to advance public policy in brain health. These goals reflect the critical advancements that are needed to achieve the AAN National Brain Health Vision proposed by the AAN as follows: (1) Brain health research leads to an accumulation of a critical body of knowledge and scientific breakthroughs; (2) preventive neurology is a thriving cross-disciplinary field that develops new leaders in brain health; (3) evidence-based practice guidelines on brain health for all ages are available and continuously updated; (4) a "brain health visit" is a standard of care and part of a "well visit" at every stage across the life span; (5) education on brain health across the life span is widely available and results in a highly aware and engaged public; and (6) a National Brain Health Plan is established to guide scientific research, care, and public engagement priorities. The AAN positions, goals, and vision for brain health are presented in Figure 3. To achieve these components of the AAN Brain Health Initiative, the AAN proposed the "Action Plan for Brain Health Across the Lifetime" (Figure 4).[26]

The action plan is focused on 5 individual life epochs across the life span: fetal and childhood development, youth and

Figure 4 The American Academy of Neurology Action Plan for Brain Health Across the Lifetime



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adolescence, adulthood, maturity, and senescence. Each epoch is centered around an overarching goal toward achieving lifelong optimal brain health, which reflects broadly on the various types of potential neurologic insults, recurrent exposures, and gene-environment interactions, as well as unique prevention and intervention strategies necessary and possible to ensure optimal brain health. For this purpose, the epochs are not defined with concrete age limits but rather reflect the stages of an individual's life span. The epoch-specific goals are presented in Figure 4.

In preparation for the 2022 AAN Brain Health Summit, 5 life epoch expert work groups were convened and charged with identifying key priorities in achieving optimal brain health within the context of each individual life epoch and developing top-line recommendations in each of the following 4 categories: (1) research gaps, (2) public policy, (3) education needs, and (4) direct-to-public messaging. The work groups were subsequently charged with identifying critical external (i.e., outside the AAN) partners and stakeholders to engage and collaborate with to achieve each set of individual work group goals. The initial top-line recommendations were presented by the work group leads at the AAN Brain Health Summit on September 15, 2022, and these initial aspirational recommendations are available on the AAN website at aan.com/initiallifestagerecommendations. The aforementioned process provided the framework for the AAN Brain Health Action Plan, a compendium of strategies and tactics prioritized to achieve overarching brain health goals of each individual lifetime epoch and designed to serve as a road map toward the AAN's National Brain Health Vision as summarized in the Table. The recommendations in the action plan represent strategic targets to be achieved in a planned manner over time and in collaboration with a broad coalition of brain health stakeholders. As part of the planning process, outcome metrics will be developed in conjunction with the assessment time line. While the ultimate criteria for success of the overall initiative and the specific recommendations are actively evolving, progress, feasibility, and relevance of the recommendations will be evaluated in an iterative process in the context of the enduring AAN Brain Health Initiative.

The AAN Brain Health Action Plan—Top-line Priorities

Research Gaps

The fetal and childhood development work group highlighted key knowledge gaps in this epoch, including the need to better understand fetal-placental interactions in relation to neural development, fetal brain development, the effect of genetic disorders on brain development, and the human exposome—the comprehensive collection of early-life exposures that have a substantive effect on the fetal brain. Research gaps identified during the youth and adolescence epoch included creating effective scalable behavioral interventions for brain health conditions, exploring how different educational environments might influence brain health trajectories and mental health, and clarifying the long-term effects of infectious diseases and environmental exposures on the developing nervous system. The adulthood work group highlighted the importance of fostering adequate infrastructure to support brain health research; conducting studies that focus on health behavior modifications, especially those related to nutrition, sleep, physical activity, and mitigation of toxic exposures, including substance abuse; and developing better biological and behavioral markers for brain health. The research needs identified for later adulthood similarly included an emphasis on developing and validating brain health measures and further highlighted the importance of a comprehensive study of social determinants of brain health and related health inequities. The senescence work group, focused on the oldest old and end of life, recommended addressing knowledge gaps in understanding the biopsychosocial pathways that underlie trajectories of brain health and aging, expanding and bridging common data elements across longitudinal studies of aging, and

Table Top-line Priorities of the The American Academy of Neurology Action Plan for Brain Health Across the Lifetime[a]

	Early development	Youth/adolescence	Adulthood	Maturity	Senescence
Research	Characterize fetal-placental interactions in relation to neural development and the effect of genetic disorders on the brain	Design accessible and scalable behavioral interventions	Develop a comprehensive infrastructure for brain health research	Design, validate, and implement ideal measures for brain health	Expand and bridge research across differing models of brain health and aging
Public Policy	Advocate for policies and programs that support the developing brain	Advance efforts to create safe and productive environments and institutions, especially for those affected by neurologic disorders	Support interventions that reduce direct and indirect medical costs while improving health outcomes	Prioritize legislative and regulatory actions that meaningfully improve determinants of brain health	Promote legislation that supports interventional and longitudinal studies of aging
Education	Support cross-disciplinary training programs to enhance the brain health of newborns	Increase common understanding of the important links between mental health and brain health	Develop comprehensive brain health curricula	Educate public and health professionals on the importance of proactive, evidence-based brain health screenings	Create and share resources to better define and enhance an individual's quality of life in late life or at the end of life
Communication	Communicate how better parental health can have a positive effect on the brain health of babies	Promotion of concussion and brain injury prevention	Advance public health education for early prevention, detection, and intervention of high blood pressure and its harmful effects on the brain	Promote campaigns that increase long-term public awareness and attention for brain health priorities	Highlight the simple ways everyone can alter the trajectory of brain aging today

[a] Some priorities proposed in this summarized list are not limited to a single life epoch; furthermore, some priorities may apply across most, if not all, life epochs.

enhancing the measurement of quality of life specific to this life stage and the late stages of progressive medical conditions. Of note, several research priorities outlined by the individual working groups may apply to multiple epochs or across the entire life span. Furthermore, all work groups acknowledged the critical importance of social and structural determinants of brain health, including diversity, equity, and inclusion. Future collaboration and coordination will be needed to develop a systematic and action-driven research plan for brain health.

Public Policy

The AAN has a long history of advocating for funding to advance research, improve patient care, and the use of evidence-based guidelines in legislative and regulatory decision making. The AAN has also guided selection of the most appropriate measures for assessing the effect of policies and programs—on health care professionals in neurology and on neurologic outcomes. Common themes emerged for legislative and regulatory priorities in brain health across all epochs. The clearest identified need was to advance policies and programs that provide meaningful, comprehensive support for the brain as early as possible and for as long as possible. Whether addressing crucial public safety needs of individuals with neurologic disorders or pushing for policy interventions that target the biopsychosocial factors and determinants of brain health at the population level, the opportunities for intervention are as diverse and numerous as they are important to raise as a societal imperative and—this cannot be emphasized enough—as one of the most important investments for a productive nation to thrive and excel.

Education Needs

Training a broad workforce of health care partners who can meet public brain health needs as they evolve and accelerate developments in this field will require coordinated, collaborative approaches across various disciplines. The work groups identified educational gaps and recommended developing brain health curricula and new training programs that not only emphasize the importance of brain health but are also specifically tailored to cultivate brain health expertise. This expertise can be cultivated in neurologists and can be strategically folded into existing medical fields, such as pediatrics and geriatrics, to affect brain health and be developed into separate fields or subspecialties. New areas of subspecialty will likely be needed most to investigate and address brain health issues that are especially unique, unmet, and complex. Whatever education and training efforts are implemented, the work groups collectively emphasized the collaborative nature of these efforts and the special care that must be taken to best leverage resources and existing knowledge and expertise.

Direct-to-Public Messaging

Effective and compelling public health communication is core to the mission of the AAN Action Plan for Brain Health Across the Lifetime. Each work group developed epoch-specific recommendations on the ideal direction that public messaging around brain health could take. Across all work

groups, members emphasized the importance of communicating messages that are supported by sound peer-reviewed scientific evidence; are immediately accessible across various ages, languages, cultural backgrounds, and levels of health literacy; and share actionable, equitable, and engaging ways to promote brain health early and consistently throughout the life span.

Summary and Future Directions—A Call to Action on Brain Health

Brain health is central to individual and collective well-being across the life span. As such, we call on neurologists and other stakeholders in brain health to use our collective efforts to accomplish our ultimate goal of reducing the current trajectory of the incidence and burden of neurologic disorders—from both illness and injury—while using a public health response for achieving optimal brain health for all. These efforts must include marshalling resources, coordinating public policy efforts, and advancing research efforts by the AAN and the broad coalition of stakeholders in brain health within and outside the field of neurology. Child and adult neurologists are natural champions for brain health because they have the dedicated expertise and experience to provide neurologic care and steward the public health mission to ensure the brain health of individuals and communities. With the significant and growing neurologic and mental disease burden in the United States and worldwide, a preventive brain health strategy led by neurologists and developed in collaboration with multiple stakeholders in brain health establishes an opportunity to advance public health, shape public policy, and promote community engagement to achieve and maintain optimal brain health throughout the course of one's life.

The AAN Brain Health Platform and Action Plan for Brain Health Across the Lifetime set the direction and scope of work needed to realize the ultimate vision and make incremental progress along the road map toward optimal brain health—in the United States and worldwide—through international collaborations. The key pillars of science, patient care, and public policy are reflected in the 3 ambitious goals of the AAN Brain Health Platform of accelerating scientific discovery in brain health through cross-disciplinary collaboration, optimizing brain health through integration of preventive care practices, and enhancing public and patient engagement to advance public policy in brain health.

As experts in brain and neurologic care, neurologists have a unique opportunity to assume leadership in brain health as a core neurologic issue and collaborate broadly to advance the future of preventive neurology and optimal brain health through scientific discovery, public policy, development of patient and professional education, and broad dissemination of trustworthy brain health information. Brain health is a cogent, forward-facing concept that is closely aligned with the AAN's mission and vision and has the potential to transform the future of neurology as a profession. Through the AAN Brain Health Initiative, neurologists will stand united with a broad coalition of multidisciplinary stakeholders for brain health across the life span for the benefit of our patients and the public.

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Justin T Jordan, MD, MPH	Department of Neurology, Massachusetts General Hospital, Harvard Medical School, Boston, MA	Drafting/revision of the manuscript for content; including medical writing for content; Study concept or design; Analysis or interpretation of data
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Appendix *(continued)*

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