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BRAIN HEALTH-DIRECTED POLICYMAKING

A NEW CONCEPT TO STRENGTHEN DEMOCRACY

Ryan Abbott
David G. Angeler
Rym Ayadi
Virginia Bennett
Michael Berk
Robert M. Bilder
Andrew Carlo
Shuo Chen
Lynne Corner
Mark T. D'Esposito
Walter D. Dawson
Frederic Destrebecq
Harris A. Eyre

Michael Freeman
Carol Graham
James T. Hackett
William Hynes
Agustin Ibanez
Dilip V. Jeste
Jorge Jraissati
Facundo Manes
Michael D. Matthews
Chee H. Ng
Wolfgang H. Oertel
Ian H. Robertson
Karen Rommelfanger

Antonella Santuccioni Chadha
Zoltan Sarnyai
Erin Smith
Jair C. Soares
Eric A. Storch
Sebastian F. Winter
Christine Yu Moutier

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AUTHORS

Sebastian F. Winter MD PhD^{1-3,*}, David G. Angeler PhD^{1,4-6}, Walter D. Dawson DPhil^{1,7-9}, Virginia Bennett¹, Michael Freeman MD^{10,11}, William Hynes DPhil¹, Michael Berk MD PhD^{1,4,12-14}, Zoltan Sarnyai MD PhD¹⁵, Chee H. Ng MBBS, MD¹⁶, Ryan Abbott, MD, JD, PhD,^{17,18} Agustin Ibanez PhD^{1,7,19,20}, Erin Smith^{1,7,21}, James T. Hackett²², Eric A. Storch PhD⁵, Jorge Jraissati^{1,23,24}, Lynne Corner^{25,26}, Shuo Chen, JD^{27,28}, Andrew Carlo^{29,30}, Robert M. Bilder PhD³¹⁻³³, Christine Yu Moutier MD³⁴, Jair C. Soares MD PhD³⁵, Rym Ayadi PhD^{1,36-38}, Antonella Santuccioni Chadha³⁹, Facundo Manes MD^{40,41}, Karen Rommelfanger PhD^{42,43}, Wolfgang H. Oertel MD^{44,45}, Dilip V. Jeste MD⁴⁶⁻⁴⁸, Frederic Destrebecq⁴⁴, Ian H. Robertson PhD^{7,49}, Mark T. D'Esposito MD^{49,50}, Michael D. Matthews⁵¹, Carol Graham PhD⁵², Harris A. Eyre MBBS PhD^{1,4,7,19,29, 53-55}

- ¹ Neuroscience-inspired Policy Initiative (NIPI), Organisation for Economic Co-Operation and Development, Paris, France
- ² Department of Neurology, Massachusetts General Hospital and Harvard Medical School, Boston, MA, USA.
- ³ Department of Neurology and Experimental Neurology, Charité – Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health, Berlin, Germany.
- ⁴ Institute for Mental and Physical Health and Clinical Translation (IMPACT), Deakin University and Barwon Health, Geelong, Victoria, Australia
- ⁵ Swedish University of Agricultural Sciences, Department of Aquatic Sciences and Assessment, Uppsala, Sweden
- ⁶ University of Nebraska - Lincoln, Lincoln, NE, USA
- ⁷ Global Brain Health Institute, University of California, San Francisco (UCSF), San Francisco, California and Trinity College Dublin, Dublin, Ireland
- ⁸ Department of Neurology, Oregon Health & Science University, Portland, OR, USA
- ⁹ Institute on Aging, College of Urban & Public Affairs, Portland State University, Portland, OR, USA
- ¹⁰ Department of Psychiatry, UCSF, San Francisco, California
- ¹¹ ECONA Center for Entrepreneurial Mental Health, San Francisco, California
- ¹² Department of Psychiatry, University of Melbourne, Parkville, Victoria, Australia
- ¹³ The Florey Institute for Neuroscience and Mental Health, University of Melbourne, Parkville, Victoria, Australia
- ¹⁴ ORYGEN Youth Health, University of Melbourne, Parkville, Victoria, Australia
- ¹⁵ Laboratory of Psychiatric Neuroscience, Australian Institute of Tropical Health and Medicine, James Cook University, Townsville, Queensland, Australia
- ¹⁶ Department of Psychiatry, The Melbourne Clinic and St Vincent's Hospital, University of Melbourne, Richmond, Victoria, Australia
- ¹⁷ School of Law, University of Surrey, Guildford, UK
- ¹⁸ David Geffen School of Medicine, University of California Los Angeles, CA, USA
- ¹⁹ Latin American Brain Health Institute (BrainLat), Universidad Adolfo Ibáñez, Santiago de Chile, Chile
- ²⁰ Cognitive Neuroscience Center (CNC), Universidad de San Andrés, and National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina.
- ²¹ School of Medicine, Stanford University, Palo Alto, CA, USA
- ²² The Hackett Center for Mental Health Policy, Houston, Texas, USA
- ²³ IESE Center for Public Leadership and Government, IESE Business School, Madrid, Spain
- ²⁴ VA Research Group, Venezuelan Alliance, Madrid, Spain
- ²⁵ VOICE, Newcastle University, Newcastle upon Tyne, UK
- ²⁶ National Innovation Centre for Aging, Newcastle University, Newcastle upon Tyne, UK
- ²⁷ College of Engineering, University of California, Berkeley, California
- ²⁸ California Mental Health Commission (Mental Health Services Oversight and Accountability Commission), Sacramento, California
- ²⁹ Meadows Mental Health Policy Institute, Dallas, Texas, USA
- ³⁰ Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA
- ³¹ David Geffen School of Medicine, University of California, Los Angeles, Los Angeles, CA, USA
- ³² Stewart & Lynda Resnick Neuropsychiatric Hospital, UCLA, Los Angeles, CA, USA
- ³³ Jane & Terry Semel Institute for Neuroscience, UCLA, Los Angeles, CA, USA
- ³⁴ American Foundation for Suicide Prevention, New York City, New York
- ³⁵ Louis Faillace, M.D Department of Psychiatry and Behavioral Sciences, UT Houston Medical School, UT Harris County Psychiatric Center, UT Center of Excellence on Mood Disorders, Houston, Texas
- ³⁶ Euro-Mediterranean Economists Association, Barcelona, Spain
- ³⁷ CASS Business School, City University of London, London, United Kingdom
- ³⁸ Center for European Policy Studies, Brussels, Belgium
- ³⁹ Women's Brain Project, Guntershausen, Switzerland
- ⁴⁰ National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina
- ⁴¹ Institute of Cognitive and Translational Neuroscience (INCYT), INECO Foundation, Favaloro University, Buenos Aires, Argentina
- ⁴² Ningen Neuroethics Co-Lab, Atlanta, Georgia
- ⁴³ Departments of Neurology, Psychiatry and Behavioral Sciences, Emory University School of Medicine, Atlanta, Georgia
- ⁴⁴ European Brain Council, Brussels, Belgium
- ⁴⁵ Department of Neurology, Philipps University of Marburg, Germany.
- ⁴⁶ Department of Psychiatry, University of California San Diego, San Diego, California, USA
- ⁴⁷ Department of Neurosciences, University of California San Diego, San Diego, California, USA
- ⁴⁸ Sam and Rose Stein Institute for Research on Aging, University of California San Diego, San Diego, California, USA
- ⁴⁹ Center for BrainHealth, University of Texas at Dallas, Dallas, Texas
- ⁵⁰ Helen Wills Neuroscience Institute, University of California, Berkeley, CA, USA
- ⁵¹ Department of Behavioral Sciences and Leadership, U. S. Military Academy, West Point, NY
- ⁵² Global Economy and Development Program, The Brookings Institution, Washington, D.C., USA
- ⁵³ Department of Psychiatry and Behavioral Sciences, Baylor College of Medicine, Houston, Texas, USA
- ⁵⁴ Department of Psychiatry and Behavioral Sciences, University of Texas Health Sciences Center, Houston, Texas, USA
- ⁵⁵ Brain Capital Alliance, San Francisco, California, USA

*Corresponding author | Sebastian F. Winter, MD PhD | sebastianfwinter@gmail.com

Abstract

Democracies are increasingly under siege. Beyond direct external (e.g., warfare) and internal (e.g., populism, extremism) threats to democratic nations, multiple democracy-weakening factors are converging in our modern world. *Brain health challenges*, including mental, neurologic, and substance use disorders, social determinants of health, long COVID, undesired effects of technology, mis- and disinformation, and educational, health, and gender disparities, are associated with substantial economic and sociopolitical impediments. Herein, we argue that thriving democracies can distinguish themselves through provision of environments that enable each citizen to achieve their full brain health potential conducive to both personal and societal well-being. Gearing policymaking towards equitable and quality brain health may prove essential to combat brain challenges, promote societal cohesion, and boost economic productivity. We outline emerging policy innovations directed at building “pro-democratic brain health” across individual, communal, national, and international levels. While extensive research is warranted to further validate these approaches, brain health-directed policymaking harbors potential as a novel concept for democracy strengthening.

Keywords:

Democracy; neuroscience; human rights; brain health; health policy; national security; misinformation

Value of brain health for democracy

A fundamental tenet of democracy is that it requires an educated and informed citizenry and elected governments to collaborate responsibly and on a trust-basis in order to expand opportunities for economic and human development and ensure security for all. Democracy is a form of self-governance based on elected political representatives that builds on and expands options by learning from and responding to knowledge, and indeed relying on such knowledge. Factors that ideally mediate well-functioning democracies are partly based on open-minded, curious, free-thinking, and responsible individuals engaged in scientific and creative pursuits who can freely disseminate knowledge. Democracies adhere to fundamental human rights protections, as recently proposed by White and Gonsalves (2021) (i.e., “(1) agency, autonomy, and self-determination; (2) freedom from want; (3) freedom from fear; (4) uniqueness; and (5) unconditionality, including protections for vulnerable populations.”)¹ Arguably, democracies that thrive are those that strive towards assuring civic engagement, evidence-based policy, equal opportunity, social mobility, freedom from corruption, freedom of thought, freedom from discrimination, self-actualization, and the lack of constraints that together create the circumstances in which “anything is possible.” By contrast, autocracies, including authoritarian and totalitarian regimes, which constrain and forcibly channel human potential, also tend to constrain knowledge and may use brute force, technology, and intelligence to control people.

The success of democracies depends on well-functioning institutions that underpin collective decision-making and its processes. Well-functioning institutions are essential to create channels for power sharing and democratize the processes; act as custodians to safeguard the democratic ideals such as freedom, equality, sovereignty, and social equity; maintain trust in the functioning and ultimately the legitimacy of the state; present the concentration of power by ensuring checks and balances; provide continuity and stability to the democratic functioning; and safeguard the rights of citizens. Yet, democracies are increasingly suffering from polarizing dynamics and conflicts between groups that can jeopardize societal cohesion and prevent unified civic engagement and strategic action against shared threats. Increasing polarization of views about urgent problems impedes societies to achieve consensus and implement cooperative actions. Partisan schism even defies issues where scientific agreement is high such as climate change or vaccination. A greater understanding of the neural mechanisms and behavioral biases underlying polarization of opinions and beliefs, as well as their antecedents and consequences, may help to devise strategies to overcome them.

The relationship between health and democracy has been actively investigated.²⁻⁴ Several cross-country studies have identified a correlation between democratic rule and improved population health, including outcome indicators such as infant or child mortality, life expectancy at birth, and the burden of injuries and non-communicable diseases.^{3,5-7} While an overarching difficulty in the field lies in establishing causality, it has been argued that causal underpinnings of the observed correlation may include greater government effectiveness of liberal democracies relative to autocratic nations.² Accordingly, effective governments may promote population health by more evidence-based implementation of proven prevention and treatment strategies, higher expenditure on public services and better delivery of such services.^{2,3} Additionally, the fact that democratic governments “*have to win elections and face public criticism*” and thus “[...] *have strong incentives to undertake measures to avert famines and other such catastrophes*” has been pointed out by Economic Nobel Laureate Amartya Kumar Sen, who

famously stated that “[...] no famine has ever taken place in the history of the world in a functioning democracy—be it economically rich (as in contemporary Western Europe or North America) or relatively poor (as in postindependence India, or Botswana, or Zimbabwe).”⁸ While causal research assessing the impacts of better population health on the performance and stability of democratic institutions is still lacking, good health is arguably highly conducive to active societal participation and civic engagement, which constitute important components of democratic systems. By contrast, it stands to reason that totalitarian regimes can evoke fear and learned helplessness and the absence of safety and control (or the perception thereof), all of which are factors associated with poor mental health outcomes.⁹

In this context, it is important to introduce the concept of *brain health*, how it relates to individual and societal well-being, and potentially the performance of democratic systems. In the World Health Organization (WHO)’s *Intersectoral Global Action Plan on Epilepsy and Other Neurological Disorders 2022–2031* good brain health is defined as “a state in which every individual can learn, realize their potential and optimize their cognitive, psychological, neurophysiological and behavioural responses, while adapting to changing environments.”¹⁰ The concept of brain health thus goes far beyond the mere absence of disease and pure biological factors, encompassing all critical areas throughout the life course and taking a person-centric approach.^{11,12} While the multidimensional scope of this concept has resulted in heterogeneous definitions of—and difficulties to objectively measure—“brain health,” a recent concept analysis that extracted attributes, antecedents, and consequences of brain health concluded that brain health may be defined as “a life-long, multidimensional, dynamic state consisting of cognitive, emotional and motor domains underpinned by physiological processes and can be objectively measured and subjectively experienced [...] influenced by eco-biopsychosocial determinants.”¹³

Herein, we explore the understudied relationship between brain health and democracy. Specifically, we carried out a scoping review to explore and map out the relationship between brain health and societal outcomes, with a focus on the impact on democratic institutions and processes. Based on our findings, we put forward the argument that democratic processes and brain health can be understood as reciprocal and mutually interdependent elements. Accordingly, provision of policies focused on maximizing brain health at individual citizen and population level (i.e., *brain health-directed policymaking*) warrants further exploration as a strategy to promote and augment stability and sustainability of democratic societies and institutions. Establishment of brain health as a novel pillar in the policy arena could serve to address existing challenges and threats to democracy and well-being at individual, communal, national, and global levels.

Brain health challenges affecting democracy

Since the turn of the millennium, democracy is increasingly under siege. There is a decline in the number of democracies worldwide and measures of global freedom are now in their 15th year of decline.¹⁴ In addition to the use of force across societal levels, such as persecution of regime-critical individuals, to the assault by one country against the democratically elected government of another state, there are a range of democracy-weakening factors converging in our modern world. These include threats from unprecedented socio-environmental factors such as the COVID-19 pandemic, climate change, economic and physical insecurity, educational and health access disparities, negative social determinants of health, sex/gender inequalities, mis- and disinformation, a growing burden of mental, neurologic, and substance use (MNS) disorders, and undesired effects of social media and technology. The resulting socio-political and economic sequelae are enormous. In fiscal terms, costs to the global economy amount to trillions of dollars per year in lost productivity.^{15,16}

Addressing these democracy-weakening factors requires a greater understanding of public attitudes and behavior, which in turn depend on brain health. At the same time, the factors themselves directly and/or indirectly impact and, reciprocally, are influenced by brain health. We have therefore previously termed and herein refer to these factors as *brain health challenges*.¹⁷ We argue that challenges to brain health of *individuals* can ultimately “percolate up” to higher system levels, thus arguably influencing “collective” brain health of whole *societies*. As such, individual and collective brain health can be understood as inherently connected, contributing to the dynamics of social-ecological systems and their resilience, including the collective “outputs” of whole nations at societal, economic, and cultural levels. Brain health may thus prove to be important determinant to functioning institutions and hence to the success of democracies and their processes. Nevertheless, brain health challenges are currently largely overlooked as a key threat to democracy and well-functioning institutions, and regrettably remain underexplored as a common thread across multiple dimensions of human societies.¹⁸

Accounting for the relationship between brain health and democracy is warranted to navigate the increasingly complex and unprecedented social and environmental challenges faced by humanity. There are ample direct and indirect factors affecting the *democracy-brain health relationship*. We demonstrate these with several concrete examples:

- **Conflicts and warfare** destabilize democratic institutions and have lasting negative impacts on brain health.^{19,20} Soldiers, the injured, women, children, the elderly, the functionally disabled, and refugees are disproportionately affected.^{21,22} Physical disability, emotional and psychological distress, post-traumatic stress disorder, anxiety, depression, insomnia, alcohol and drug abuse, suicidality, loss of social engagement, and psychosomatic illnesses are prevalent among those who live in or have been exposed to war-torn areas.^{19,21,23–25} The sequelae of stress and trauma can even negatively impact subsequent generations via parental stress-mediated effects in offspring, including epigenetic mechanisms, in a concept referred to as *intergenerational transmission*.^{26–29} Emerging community-based mental health literacy interventions

directed at fostering brain health awareness, agency, and self-efficacy have shown benefit in conflict prevention and management among refugees, citizens, and ex-combatants.^{23,30,31} These “bottom-up” or grassroots interventions at individual and community levels can be complemented by “top-down” population-level strategic initiatives that incorporate consideration of social and geopolitical determinants of health.³² Moreover, insights from behavioral neuroscience in conjunction with digital applications could be harnessed to inform and complement evidence-based best practices in conflict resolution and peacebuilding at individual, communal, national, and international levels. The unique value of *behavioral science* to more effectively navigate our modern world has also been recognized by the United Nations following inclusion of this discipline as a pillar in the “quintet of change” of the United Nations 2.0 strategy, “a new version [of the UN] that is able to offer relevant and system-wide solutions to the challenges of the twenty-first century.”³³

- Understanding brain health as a precondition for **human security** is a fundamental pillar of democracy. As noted in the 2022 UNDP Human Security Report, addressing mental health is indispensable to advancing human security: “Often overlooked as a human security issue, mental health is essential for people to enjoy secure lives. So, failing to address mental health amounts to neglecting a major ongoing threat to human security and can leave health systems unprepared for future mental health crises.”³⁴
- Recognizing the growing crisis of **despair** in our democratic societies is an issue of national security. Lack of hope and despair, broadly defined as “the plight of the many that are ambivalent about whether they live or die,”³⁵ are growing societal challenges in many Western democracies. In the United States, deaths of despair (suicide and poisoning by alcohol and drugs) are now so prevalent that they are lowering the average U.S. life expectancy.³⁶ In addition, the COVID-19 pandemic and associated social and economic impediments have exacerbated this trend. We have recently highlighted a critical need for federally coordinated policy measures in the United States to adequately address the complex bio-psycho-social root causes of despair.³⁵ If left unaddressed, the growing crisis of despair could substantially harm societal well-being, health, longevity, economic productivity, and national security.³⁵ Downstream effects of despair are postulated to include heightened susceptibility to mis- and disinformation, including fake news and conspiracy theories, far-right radicalization, and extremist activities.³⁷ Such phenomena result in greater liability to *external* (interference by foreign actors in elections and state affairs) and *internal* (political polarization, societal disunity, impaired strategic action against shared threats such as COVID-19 or climate change) threats to national security and stability of democratic institutions. A greater understanding of the neuroscientific basis of despair along with policy measures aimed at fostering brain health and skills (i.e., resilience) are pivotal.
- There is an ongoing scientific debate surrounding the **effects of digitalization** (digital systems, smart devices, and artificial intelligence) on human cognition and agency, which are critical to functioning democracies.³⁸⁻⁴¹ For instance, a growing reliance on digital tools such as smartphones may result in difficulties with attentional processing and control, the neural correlates of which are now measurable by advanced imaging modalities.⁴² It has been postulated that such “digitally impaired cognition” could potentially undermine freedom of choice and agency, thereby indirectly undermining “three pillars of democracy: a well-informed population, resilience to foreign influence, and

the capacity for effective public debates".⁴³ In addition, the social media driven process of "monetized attention" has the potential to further erode personal autonomy and self-efficacy, and can make individuals and corporations adversaries in a battle to manage goal-directed behavior.³² On the other hand, digital tools carry tremendous therapeutic potential and, in the clinical neurosciences arena alone, several digital therapies have been successfully put forward. A comprehensive overview of such emerging "Brain Capital Start Ups" has been previously published elsewhere.⁴⁴

Role of dignity neuroscience in policymaking

The relationship between democracy and brain health can be further explored from a human rights perspective. A new model of *dignity neuroscience* has outlined the intricate relationship between human rights, human dignity, and the human brain.¹ Serving as the common moral basis for human rights, human dignity constitutes an essential *leitmotif*, anchored firmly in international treaties, such as the 1948 Universal Declaration of Human Rights, the 1966 International Covenants on Civil and Political Rights (ICCPR), the 1997 European Convention on Human Rights and Biomedicine, and, more recently, the 2030 Sustainable Development Goals of the United Nations. As such, human dignity serves as a pillar of the democratic process, informing our ethical and legislative frameworks and common societal values. Accordingly, the concept of human dignity has been increasingly explored and applied as a guiding principle across a multitude of disciplines, including politics and policymaking,^{45,46} jurisdiction,⁴⁷ public health and bioethics,⁴⁸ business,⁴⁹ and the workplace.⁵⁰ From a neuroscience perspective, according to White and Gonsalves (2021), human rights—agency, autonomy, and self-determination; freedom from want; freedom from fear; uniqueness; and unconditionality, including protections for vulnerable populations—are grounded physiologically in *intrinsic human dignity*. As emergent, fundamental properties of the human brain, human dignity and human rights are therefore indispensable to brain health and societal well-being. Based on this normative foundation White and Gonsalves (2021) propose a novel cross-disciplinary neuroscience-based framework for universal human rights—*dignity neuroscience*—that harnesses and integrates neuroscience insights to holistically inform and advance human rights locally, nationally, and internationally.¹ We argue that dignity neuroscience can and should serve as a valuable ethical framework to guide and inform brain health-directed policymaking.

Towards brain health-directed policymaking: Setting priorities

Among the multitude of brain health challenges affecting the performance, cohesion, and sustainability of our societies and democratic institutions, we argue that a critical set warrant priority attention in current and future brain health-directed policy agendas:

Addressing the burden of mental, neurologic, and substance use disorders

Mental, neurologic, and substance use (MNS) disorders account for a substantial and growing proportion of the global burden of disease, whereby neurologic disorders alone are the leading cause of disability-adjusted life years (DALYs).⁵¹ It is estimated that nearly one in three individuals will develop a neurologic disorder throughout their life course.⁵² The criticality to address the growing burden of MNS disorders has most recently been emphasized by WHO in the 2022 launch of its first position paper on brain health, as *“a conceptual framework for optimizing brain health across the life course and [...] establishing brain health as a global policy priority.”*¹² In particular, the discrepancy between limited and unevenly distributed global action on brain health and, on the other hand, the alarming rate of demographic change with rising prevalence of associated age-related brain disorders (including dementia and stroke) has been pointed out.¹²

To achieve better brain health at societal level it is critical to ask how the extent of national and international brain health can be quantified. DALYs and deaths attributable to MNS disorders constitute quantifiable indicators. As one example, suicide has been a leading cause of death globally for many decades with a substantial associated emotional and economic burden. In recent years, the WHO and the United Nations have adopted action plans focused on brain health and suicide prevention,⁵³ and have set goals to reduce the rate of suicide by varying degrees: 10 percent by 2020 in the case of WHO, and 33 percent by 2030 in the case of the UN Sustainable Development Goals. As of 2022, 46 countries have enacted national strategies to prevent suicide,⁵⁴ and reductions in suicide rates have been observed in several countries, including China, Denmark, the United Kingdom, Switzerland, the Philippines, and South Korea.⁵⁵ As numerous evidence-based strategies to reduce suicide risk at population level have been put forward,^{56,57} the extent to which a nation implements a national suicide prevention plan could arguably serve as one fair indicator of its commitment to brain health.

Depression (broadly defined to include clinical depression and states of dysthymia) and despair in democratic societies are associated with negative downstream effects at both individual (e.g., personal well-being, self-actualization, health, longevity) and societal (e.g., cohesion and resilience of families and communities, economic productivity) levels. We have previously argued that depression, despair, and social alienation can result in a reduction of civic engagement and economic productivity, thereby weakening the democratic processes and institutions on which our economies and national securities rely.³⁵ As such, individuals suffering from psychological vulnerabilities (particularly children and youth) are potentially more susceptible to mis- and disinformation, as well as political polarization and extremism, and associations between these phenomena remain an active area of investigation.⁵⁸⁻⁶⁰ Depression

also increases the risk for numerous health and functional outcomes including increased cardiac mortality, stroke, and other mental and physical health outcomes, as well as unemployment.^{61–63}

Several strategies have emerged to address the growing burden of depression and other mental health disorders. New predictive technologies, judiciously used, could provide insights for early treatment of mood disorders and suicide prevention. For example, the *NIH BRAIN Initiative* recently explored a research agenda called Brain Behavior Quantification and Synchronization that would effectively bridge brain activity in the real world for improved understanding of human behavior and improved mental health outcomes.⁶⁴ From a policy side, a recent exemplary strategy is the *Mental Wealth Initiative* (MWI). Launched by the University of Sydney's Brain and Mind Centre in Australia, the MWI is a transdisciplinary enterprise aimed at measuring, modeling, and forecasting the Mental Wealth of nations.⁶⁵ Accordingly, the MWI may serve as a valuable cross-sector framework to understand how *"policy-mediated changes in economic, social, and health sectors could enhance collective mental health and wellbeing, social cohesion, and national prosperity."*⁶⁵

Aligning education and brain development

To build and sustain a competitive advantage in our rapidly changing, increasingly complex, and globally connected world, fostering a best-in-class workforce—based on ensuring that citizens can fully develop their individual talents and capacities—is critical. An impetus therefore lies on gearing education systems towards integrating education policies that foster optimal early brain development among children and youth.⁶⁶ The brains of children house the minds of the future. It is often overlooked that optimal brain health of future individuals starts before conception. As part of the transformative process in educational systems, individuals should thus be educated about the impact of lifestyle choices on brain development before and during pregnancy. Nurturing high-potential brains in the very earliest stage of life may be a critical yet underleveraged way to empower societies and for young and future generations to both create and navigate a panoply of future challenges. Complex issues already impacting our societies today only stand to become more difficult as our children grow older. Reduction of child poverty, provision of universal pre-kindergarten, and national paid leave programs can significantly facilitate positive brain development.^{66,67} Such society-level factors comprise top-down strategies directed at transforming system structures to overcome brain challenges. Additionally, the therapeutic potential of emerging technological applications, including invasive (brain-computer interfaces; deep brain stimulation) and non-invasive (NIBS) neurotherapeutics, to assist with the neurodevelopmental process must be carefully balanced with ethical considerations pertaining to the needs and rights of families and for children to have an open future with room to determine their own lives as adults.⁶⁸

Addressing despair-related national security risks

Addressing the growing crisis of despair among Western democratic nations requires comprehensive and coordinated policy efforts directed at the bio-psycho-social *root causes* of hopelessness and despair at individual, community, and societal levels. In the U.S. setting, we recently proposed a new *federal interagency task force* "to coordinate existing and new efforts to address addiction, despair, and economic recovery as a critical first step, making the whole greater than the sum of its parts."³⁵ This task force would develop and coordinate novel tools to effectively monitor and evaluate trends in national and community level ill-being and well-being

and leverage existing surveying efforts across a range of federal agencies, including the Federal Reserve and Bureau of Labor Statistics (BLS), Health and Human Services (HHS), the Centers for Disease Control and Prevention (CDC), and the Census Bureau.³⁵ Moreover, neuroscience-informed insights into the mechanisms driving despair of individuals, communities, and societies and associated sociopolitical and economic outcomes (e.g. the SMA/McCauley Two Pyramids Framework created by the U.S. Department of Defense in partnership with Dr. Clark McCauley), can be leveraged to inform evidence-based brain health-directed policymaking.³⁵

Promoting brain health diplomacy

The provision of quality and accessible brain health care is not only a demonstration of respect for human rights,⁶⁹ but arguably a social and economic imperative. An important task for brain health diplomacy is the fostering of brain health in low- and middle-income countries (LMICs). LMICs bear approximately 70 percent of the global burden of MNS disorders yet suffer from substantial access inequities and a paucity of services directed at provision of adequate brain health care.¹² In particular, reduction of stigma, promotion of brain health literacy, and advocacy for mental and brain health care across government and public and private sectors are essential levers to achieve global equity in brain health. We recently put forward an interdisciplinary model of brain health diplomacy that builds on several theoretical approaches, including health diplomacy, science diplomacy, innovation diplomacy, and convergence science.⁷⁰ Brain health diplomacy is aimed at tackling macro- and micro-level threats (i.e., top-down and bottom-up factors to brain health). These include societal problems related to war and armed conflict, the socio-ecological effects of climate change, and challenges associated with a rapidly aging population; training and connecting the next generation of leaders in brain health; collaborating in expanding prevention, screening, and treatment interventions; improving knowledge dissemination; and engaging in advocacy.⁷⁰

Brain health diplomacy could be used to strengthen existing alliances and multinational partnerships. Through diplomacy, the opportunity exists to encourage countries to collaborate and share information about mental and brain health best practices at public health events of international concern. Brain health diplomacy can foster international partnerships focused on addressing common brain-related threats and the fallout of those threats. For instance, loneliness and social isolation induced or exacerbated by the COVID-19 pandemic are, broadly speaking, worldwide phenomena affecting nearly all countries and regions. A common response is needed, built on formal commitments by countries to make the necessary investments and enact evidence-based policies to address this threat.

Responsible advancement and regulation of human enhancement and dual-use neurotechnology

Several countries are advancing brain-computer interface (BCI) innovation for both civilian and military usage.^{71,72} This forces democratic nations into a decision about how to manage their own investments in military applications of neuroscience research and emerging neurotechnology. In the context of military usage of these technologies, if Western nations are not competitive with Chinese innovation, they may be outcompeted in human enhancement (HE).⁷¹ However, HE technologies have profound ethical concerns pertaining to weaponization of such technology, as well as risks to data privacy and individual autonomy. As such, the U.S. Congressional Research Service has identified BCI as an emerging “dual-use technology” that should be considered for export controls.⁷¹ Recently, Kosal and Putney put forward an analytical

framework that “attempts to predict the dissemination of neurotechnologies to both the commercial and military sectors in the United States and China.”⁷² In reviewing the qualitative and quantitative indicators of BCI adoption, they hypothesize that China will likely adopt and disseminate BCIs in both the commercial and military sectors before the U.S. Beyond direct implications to U.S. national security, global challenges of such late adoption relate to an inability to set international ethical and legal norms for BCI use, as well as data privacy risks in the setting of commercialized BCI.⁷² The authors suggest a number of reasons for the predicted earlier adoption of BCI by China, including differences in government structure, sociocultural norms and values, and greater alignment of brain project goals with military goals.⁷² Nixdorff et al. (2017) have pointed out that dual-use nano-neurotechnologies capable of optimizing our understanding and treatment of central nervous system disorders (e.g., via advanced drug delivery), could equally be misused to maliciously disrupt the synaptic organization of the brain, and therefore strongly encouraged regulatory action by the Organization for the Prohibition of Chemical Weapons and other pertinent global bodies.⁷³ The profound ethical challenges associated with dual-use neurotechnologies, artificial intelligence, and HE underscore the need for strategic governmental oversight and internationally aligned consensus on bioethical frameworks to guide responsible innovation, regulation, and dissemination of such technology. For instance, the *Just Enhancement Theory (JET) framework*, proposed by Laurence and Carlisle (2019), may serve as a structured ethical compass to assess potential HE interventions.⁷⁴ JET stipulates that just HE interventions should satisfy the three categories of 1) *JAE—jus ad enhancement* (including the elements of *Just Cause, Proportionality, Right Intention, and Publicity*); 2) *JIE—jus in enhancement* (i.e., research and implement HE interventions in an ethical manner); and 3) *JPE—jus post enhancement* (i.e., ensure that the enhanced individuals and the larger society are not worse off due to the HE intervention).⁷⁴ *Dignity neuroscience*, which includes safeguarding of human dignity and the unconditional worth of every human being, can and should serve as an important and robust bioethical *leitmotiv* in applying existing ethical frameworks like JET to emerging technologies, as well as informing regulatory policy efforts of democratic nations.

Fostering information literacy to combat misinformation

Misinformation represents one of the greatest challenges of the 21st century, posing a major threat to our democratic institutions.^{75,76} Over the past decade alone, the world has experienced a substantial increase in misinformation impacting a host of contemporary socio-political processes, including national elections and referenda, domestic societal phenomena (political polarization and persecution), our global response to humanity's greatest contemporary challenges such as climate change and the COVID-19 pandemic,⁷⁵ and, most recently (at the time of this report's publication), the use of force by one country against the democratically elected government of another. With global interconnectedness, the rise of social media, and technological advances in big data and artificial intelligence, misinformation (i.e., any false information) and disinformation (i.e., intentional spread of misinformation) phenomena have reached unprecedented dynamics and levels of sophistication. Targeted disinformation campaigns channeled through social media and tailored to individual personality traits are potentially capable of influencing attitude formation and decision-making of millions of people and can be weaponized to steer societal behavior, provoke civil unrest, and destabilize democratic processes. Beyond immediate harmful effects, research suggests that exposure to misinformation may result in long-term sequelae to cognitive agency.⁷⁷ Conversely, the actual cognitive/emotional state of the brain can influence susceptibility to misinformation. As such, profound and chronic stressors, such as those associated with living in war-torn areas and with

hopelessness and despair (see above), can alter information processing⁷⁸⁻⁸⁰ and potentially boost receptiveness to oversimplified, populist, political messages at the detriment of truthful information. Notably, weaponizing social media with the goal to influence and/or decrement cognitive functioning is not confined to nation states; online radicalization and cyber-recruitment strategies have been successfully deployed by ideological and extremist groups of diverse spectra to exert influence and gain power.^{81,82}

Governments worldwide face pressure to shield their citizens from emotionally harmful information, yet many policies remain insufficient and/or become rapidly outdated, highlighting a need for more efficacious strategies.⁸³ Early but promising approaches to combat misinformation include the emergence of entirely new research fields like *infodemiology*⁸⁴ and *cognitive immunology*.⁸⁵ In response to the COVID-19 infodemic, WHO has put forward an Infodemiology Research Agenda, with the aim “to strengthen the global evidence base on infodemic management to inform the development of action-oriented guidance, support options, mechanisms and tools for infodemic managers and emergency programme managers.”⁸⁶ Moreover, investments into neuroscience research and brain health-directed policy could prove critical to understand and effectively address the antecedents and consequences of misinformation exposure. This includes understanding the limitations of conventionally used strategies (i.e., fact-based correction, addressing logical fallacies, and probing source credibility), evaluating emerging *prebunking* (pre-emptive) and *debunking* (reactive) interventions,⁷⁵ and trialing novel strategies such as *information literacy* and debias training,⁸⁷ ‘inoculation’ interventions,⁸⁸ and normative, value-based approaches to belief systems.⁸⁹

The emerging concept of brain capital

A new approach to safeguard and advance democratic nations and their economies and societies is warranted. We recently proposed a novel asset—brain capital—which we believe has the potential to inform more nuanced policy development.^{17,90} Brain capital can be defined as a new econometric asset which prioritizes, integrates, and optimizes for brain health and brain skills (e.g., resilience, creativity, wisdom). As such, gearing policies towards maximizing brain capital may serve as a new approach to drive economic empowerment, societal resilience, and stability of democratic institutions. The cognitive and emotional resources that allow us to navigate new and complex challenges and develop the full potential of each person can make the difference between nations that prosper and those that do not. As brains are indispensable drivers of human progress, brain capital may provide an opportunity to invest in these valuable assets and nurture healthier, more resilient, and flexible brains. As we noted previously, brain capital is not captured by any existing economic measures such as gross domestic product (GDP) and will require the development of novel metrics and unique tools to enable objective measurement and quantification of progress.⁹¹

We previously articulated a Brain Capital Grand Strategy,¹⁷ which has three main components: 1) considering brain capital in-all-policies; 2) developing a comprehensive investment plan to support brain capital; and 3) generating a *dashboard* for objective rather than subjective assessments of brain capital.¹⁷ Brain capital in-all-policies is conceptually broad with implications and opportunities ranging from fighting poverty to promoting space flight. In foreign affairs and trade, a “brain health diplomacy” approach has been proposed.⁷⁰ In gender issues, major breakthroughs may arise from a specific focus on sex and gender differences in brain function, clinical care pathways, and social determinants. With regard to poverty, the World Bank estimates that, globally, an additional 88–115 million people slipped into extreme poverty in 2020, largely driven by the COVID-19 pandemic.⁹² The unprecedented ramifications of the *COVID-19 caesura*⁹³ are also expected to translate to major brain health disturbances due to financial stress and hardship, trauma, reductions in educational attainment, and malnutrition.

Taking a brain capital approach also provides economic opportunities to address brain health issues in the context of improving performance within the fields of innovation and entrepreneurship, both of which matter more than ever in today’s innovation-driven, interdependent, competitive, and volatile global economy.⁹⁴ Because most new jobs are created by firms less than five years old,⁹⁴ creative and innovative entrepreneurs—with their increasingly recognized brain-behavioral differences—are needed to drive regional and national social and economic growth. Today, more than ever before, our economy is transformed more by unique human brain skills (creativity, intuition, visions, resilience, wisdom) than by raw materials, technology, or knowledge. In many ways, entrepreneurs stand as a firewall against recession and deprivation, serving as economic first responders when catastrophic events produce national and global economic shocks, thereby creating resilience. An obvious and recent example lies in the vast numbers of startups emerging and scaling during the COVID-19 pandemic, successfully disrupting whole industries (including communications, delivery, and food retail industries).

Brain capital may further provide a transdisciplinary framework for organizing and accelerating existing constructive projects, both public and private. A such, a potential Brain Capital Investment Plan may serve to leverage diverse sources of capital (e.g., venture capital, private equity, government grants, philanthropy, healthy brain bonds, megafunds, and Environmental-Social-Governmental [ESG] Exchange Traded Funds) to achieve its aims.¹⁷ Private sector investors actively understand the criticality of investing in brain health, thus fundamentally recognizing the importance of building brain capital. One indicator is venture capital investments in mental health technologies, which neared US \$1 billion in 2020^{90,95} and reportedly over US \$5.1 billion in 2021.⁹⁶ At least seven mental health startups have reached “unicorn” status (i.e., valuations over \$1 billion).⁹⁷ For example, Lyra Health, a technology-enabled workplace mental health provider, reached a valuation of \$2.25 billion and has visibly increased workplace mental health support. Collaborative initiatives such as The United Kingdom Mental Capital and Wellbeing Report, The European Brain Initiative, The Davos Alzheimer’s Collaborative, The United Nations Development Programme 2022 Human Security Report and The BrainHealth project deserve mention below as initiatives that pave the way for more sustainable mental healthcare support. An ambitious framework to measure brain capital at a global level could provide policymakers a view on how brain capital dimensions can be explored and improved.⁹⁸

Fostering a pro-democratic brain health environment

Considering the above-mentioned challenges, opportunities, and dynamics, we propose a new operational model for brain health-directed policymaking aimed at fostering a pro-democratic brain health environment. **Figure 1** outlines a diagrammatic overview of this model. Brain health-directed policies can be relevant at multiple scales (i.e., from individual, family, and community to national and global societal levels). Accordingly, *key policy elements* such as resilience to mis- and disinformation, effective education and lifelong learning, promotion of essential brain skills, preventing and managing MNS disorders, support of early brain development, responsible advancement of neurotechnology, and the fostering of social cohesion are advanceable across all levels of society through leveraging *actionable guides*. These guides consist of a set of neuroscience-inspired strategies, frameworks, and metrics directed at operationalizing and streamlining proposed policy initiatives and aligning them with existing legislative structures. Notably, design and delivery of brain health-directed policies should be goal-oriented and aligned with *desired/expected outputs*, including societal well-being and flourishing, improved productivity and creativity, and a reduction in rates of radicalization, science denialism, and cognitive biases, all of which are intended to strengthen a pro-democratic environment.

Figure 1. Operational policy model for a pro-democratic brain health environment

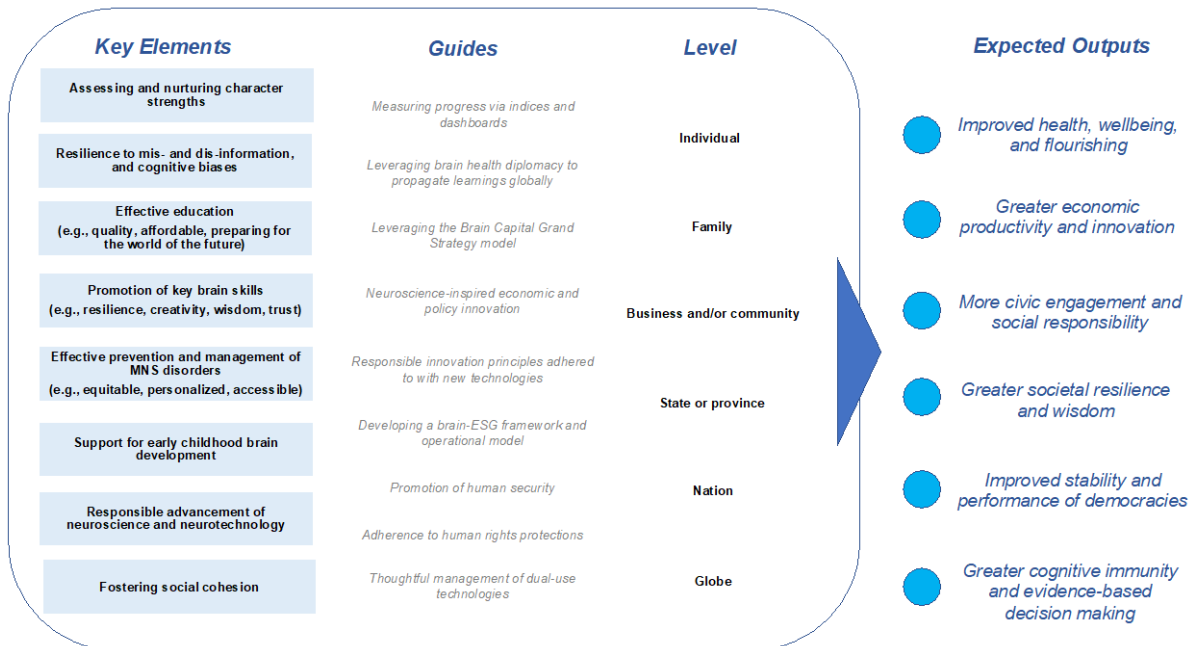


Table 1 demonstrates actionable approaches to implement this model across multiple levels. To our knowledge, the proposed model is unique and may serve as a valuable and innovative framework to stimulate and inform new approaches to public policy.¹⁸

Table 1. Advancing key elements of brain health-directed policymaking across multiple levels

Key element	Individual	Family	Business and/or community	Nation	Globe
Effective education and lifelong learning	<ul style="list-style-type: none"> Considering education across the lifespan. Educating not only traditional courses but also modern skills such as digital literacy, coding etc. Advancing the understanding of neurodiversity and learning disorders. Ensuring effective screening and intervention for learning disorders. 	<ul style="list-style-type: none"> Encouraging parental engagement in childhood learning. Encouraging child support of older adult upskilling and reskilling and lifelong learning. 	<ul style="list-style-type: none"> Encouraging businesses to employ neurodiverse employees. Support whole-of-community educational activities. Encourage businesses to fund upskilling and reskilling of employees. 	<ul style="list-style-type: none"> Tracking within country indices for education quality. Optimizing education quality equity. Ensuring financial incentives for education across the tertiary to late-life spectrum. 	<ul style="list-style-type: none"> Tracking global education quality indices. Promoting global collaboration in best practices for learning across the lifespan.
Promotion of key brain skills	<ul style="list-style-type: none"> Becoming equipped with understanding of the sciences of learning, creativity, wisdom and resilience. 	<ul style="list-style-type: none"> Provide opportunities to engage with cultural events and activities in the community. Teach resilience and adaptability to children. 	<ul style="list-style-type: none"> Supporting businesses that develop brain skills in users. 	<ul style="list-style-type: none"> Teaching brain skills as a part of education curriculum. Promote lifelong learning opportunities. 	<ul style="list-style-type: none"> Annual brain skills report globally. Development of a brain skills dashboard.
Effective management of MNS disorders	<ul style="list-style-type: none"> Ensure personalized, equitable, easily accessible brain health care. 	<ul style="list-style-type: none"> Promote support for families and caregivers. 	<ul style="list-style-type: none"> Optimize the investment of businesses in brain health solutions. 	<ul style="list-style-type: none"> Develop and advance a brain-ESG framework. Provision of universal health care. Enforce parity in access to care. Promote models for task sharing. 	<ul style="list-style-type: none"> Develop and advance a brain-ESG framework. Ensure global coordination of standards and dissemination of best practices. Support LMICs in scaling up services.
Support for early childhood brain development	<ul style="list-style-type: none"> Learn the science behind healthy brain development before and during pregnancy. Seek perinatal mental health support. 	<ul style="list-style-type: none"> Promotion of positive parenting programs, familial education. 	<ul style="list-style-type: none"> Support social prescribing for opportunities for parents and their children to engage with community events and social support, especially during ages 0-5. 	<ul style="list-style-type: none"> Develop policies to mitigate loneliness and promote social connection and social health. Promote culturally adaptive solutions 	<ul style="list-style-type: none"> Determine “blue zones” for early childhood brain health across the world and determine best practices.
Continued advancement of neuroscience and neurotechnology	<ul style="list-style-type: none"> Fund neuroscience across the translational continuum (T0, discovery; T1, first in humans or proof of principle; T2, clinical trials; T3, health-care policy and guidelines; T4: long-term effectiveness and safety, and T5, global health). 	<ul style="list-style-type: none"> Advance social neuroscience research within the family context. 	<ul style="list-style-type: none"> Promote and encourage private sector businesses to engage in CNS research and innovation. Encourage corporate innovation and corporate venture activities in neuroscience. Promote communities of responsible neurotechnologists. Advocate the brain-ESG framework. 	<ul style="list-style-type: none"> Develop courses on neuroscience and neurotechnology that can be taught to primary and secondary school students. Support neurotechnology innovation competitions. 	<ul style="list-style-type: none"> Continue to invest in global neuroscience collaborations which pool resources and foster diplomatic linkages. Support the development of global public-private partnerships, which advance neuroscience discoveries (e.g., Davos Alzheimer’s Collaborative).
Social cohesion	<ul style="list-style-type: none"> Promoting pro-social behaviors. Understanding the 	<ul style="list-style-type: none"> Supporting family-unit resilience and connectedness. 	<ul style="list-style-type: none"> Promotion of strategies to reduce social 	<ul style="list-style-type: none"> Approaches to reducing social isolation. 	<ul style="list-style-type: none"> Emphasis on and investment in cultural diplomacy

	impacts and drivers of social isolation across generations.		isolation across generations.	<ul style="list-style-type: none"> Intergenerational activity policies. 	and all other forms of diplomacy.
Resilience to mis- and dis-information, and cognitive biases	<ul style="list-style-type: none"> Optimize the neuroscience-based understanding of mis- and dis-information susceptibility and resilience. 	<ul style="list-style-type: none"> Develop and promote family-based interventions. 	<ul style="list-style-type: none"> Promote initiatives to educate people to identify, avoid and repel misinformation. Invest in startups that detect and prevent the spread of misinformation, foster information literacy/cognitive immunology, improve fact-checking / pre- and de-bunking. 	<ul style="list-style-type: none"> Anchoring information literacy on education agendas. Foster citizen awareness and empowerment. Investment in research for new solutions (e.g., infodemiology, cognitive immunology). 	<ul style="list-style-type: none"> Improved regulation of big tech (e.g., integration of fact checking and removal of misinformation content, data transparency). Global collaboration with countries and international organizations (e.g., UN, WHO).
Character strengths	<ul style="list-style-type: none"> Access to self-assessment tools to identify unique character strengths. Provision of tailored self-development trainings to foster character traits and virtues conducive to improved brain health and wellbeing (e.g., resilience, wisdom, creativity, empathy, social intelligence, temperance). 	<ul style="list-style-type: none"> Leverage insights from positive psychology and neuroscience to develop holistic parenting programs directed at nourishing the child-parent relationship and promoting character strengths from early childhood onwards. 	<ul style="list-style-type: none"> Investing into community-based programs and initiatives that promote the <i>individual and communal value</i> of building character strengths. 	<ul style="list-style-type: none"> Fostering integration of conceptual character strength frameworks into policymaking (e.g., resilience and wisdom-informed health and social policy). Development and promotion of context- and or sector-specific resilience programs (e.g., the US Army's Comprehensive Soldier and Family Fitness (CSF2) Program). 	<ul style="list-style-type: none"> Anchor the promotion of character strengths within existing global brain health agendas (e.g., UN, WHO). Launch international research consortia to further elucidate 1) determinants of character strengths, 2) value for brain health, 3) translational potential for policymaking.

Brain health-directed policymaking in practice: Emerging agendas

Until recently, approaches to dealing with brain health-directed policy and governance issues remained largely siloed and insufficient. Because *brain health challenges* cut across multiple academic disciplines, policy areas, and sectors of government, addressing them holistically requires close intersectoral collaboration, mutual consensus, and coalesced efforts. The 2022 ratification of WHO's *Intersectoral Global Action Plan on Epilepsy and Other Neurological Disorders* along with WHO's most recently launched Position Paper on *Optimizing Brain Health Across the Life Course* constitute milestones that highlight the fundamental importance of brain health to the well-being and advancement of our societies and underscore the urgency to anchor brain health on the public policy agenda at a global level. Beyond these exemplary global initiatives, several promising national, regional, and global policy initiatives have emerged over the past decades. These include brain health-directed policy agendas in the United States, Europe, Latin America, and global initiatives (detailed descriptions in **Appendix**).

While global initiatives are paramount to promote and advance brain health, effective design and implementation of brain health-directed policy agendas at national and/or regional level warrants *context specificity* (i.e., reflecting sociocultural and environmental factors and potentially unique priorities and needs).

Addressing challenges and limitations

The herein proposed model provides a frontier and interdisciplinary approach to brain health-directed policymaking and economic strategy, with the aim to foster performance, cohesion, and sustainability of democratic societies. Responsible and ethical advancement of this novel conceptual approach warrants extensive implementation research and rigorous monitoring and evaluation of piloted policy efforts. In addition, several important challenges, limitations, and pitfalls must be addressed:

- **How do we adequately and effectively measure emerging concepts like brain health and brain capital?** Identification of feasible tools that objectively measure and quantify brain health at individual, community, national, and global levels is pivotal to evaluate and refine policies and their impact. We believe a convergence of pro-democratic brain health indicators may be useful. For example, there is a Media Literacy Index,⁹⁹ a Human Capital Index,¹⁰⁰ a Freedom Index,¹⁰¹ the Global Peace Index,¹⁰² and a Better Life Index¹⁰³ as well as many similar policy-relevant metrics to measure educational attainment and health care quality and access. A dashboard approach with multiple indices may provide a holistic assessment and quantitative approximation of brain health. Notably, the OECD “Responsible Innovation in Neurotechnology” principles may provide valuable guidance in developing this measurement system and broader policy innovation agenda.¹⁰⁴ This means ensuring the importance of *“(1) high-level values such as stewardship, trust, safety and privacy in this technological context, (2) building the capacity of key institutions like foresight, oversight and advice bodies, and (3) processes of societal deliberation, inclusive innovation, and collaboration.”*¹⁰⁵
- **How can global brain health equity be promoted and achieved?** There are profound inequities in access, outcomes, and investments between low- and middle-income settings vs. high income settings. It is critical that the approach mentioned herein does not widen these inequities. Several organizations are already dedicated to foster brain health in LMICs and promote equity at global level, including the Global Brain Health Institute, the Davos Alzheimer’s Collaborative, the Healthy Brains Global Initiative, the Latin American brain health institute, and Alzheimer’s Disease International. Additionally, the emerging concept of brain health diplomacy may serve to foster brain health literacy, advocacy, and the sharing and translation best practices particularly in LMICs, where brain health care access and services remain largely insufficient. While the COVID-19 pandemic has demonstrated that international collaboration is critical to effectively address and navigate shared global threats, substantial shortcomings of globally coalesced efforts, especially with regards to insufficient resource allocation and services access in LMICs, remain and must be addressed.
- **Reducing the risk of a “neurotopia”:** any model directed at optimizing brain health is inherently at risk of wrongful interpretations, including misuse by power brokers and dogmatic and/or discriminatory proclamations that “brain healthy people are superior to brain unhealthy people”. A precondition of this model is therefore its fundamental

rooting in *dignity neuroscience*, which includes safeguarding of human dignity and the unconditional worth of every human being. Advancement and implementation of this model must therefore be driven by responsible innovation principles and adherence to its ethical underpinnings, inter alia to ensure oversight, safeguarding of brain and mental health data, promotion of trust and prevention of misuse.

- **Accounting for the challenge of two-party systems of democracy:** There are clear trends of political polarization within many democracies.¹⁰⁶ It is possible that two-party systems of democracy—and those systems dominated by two parties—are problematic in entrenching “us” vs “them” mentalities, thus weakening the democratic process. Indeed, a recent study showed that biased processing (i.e., “neural polarization”) in the brain may drive divergent interpretations of political information and subsequent attitude polarization.¹⁰⁷

Conclusion

Since the turn of the millennium, democracies have faced a range of emerging existential threats, many of which are rooted in *brain health challenges*. Anxiety is rising among citizenry, political and economic stakeholders, and analysts of governance about whether democratic governments can cope with resultant policy problems.¹⁰⁸ Developing durable, wide-ranging, lifespan, cross-sector, multi-level brain health-directed policy agendas can serve to augment the performance, cohesion, and sustainability of democratic societies.¹⁰⁹ This may prove critical for democracies to sustain themselves into the mid-21st century by promoting civic engagement, good governance, and strategies to combat national and global security challenges. Brain health investing has the potential to be not just a guarantor for societal and economic prosperity and the democratic process, but also a new vector for effective and healthy competition against near peers. At the same time, global initiatives are warranted and paramount to achieve equity in brain health.

Appendix

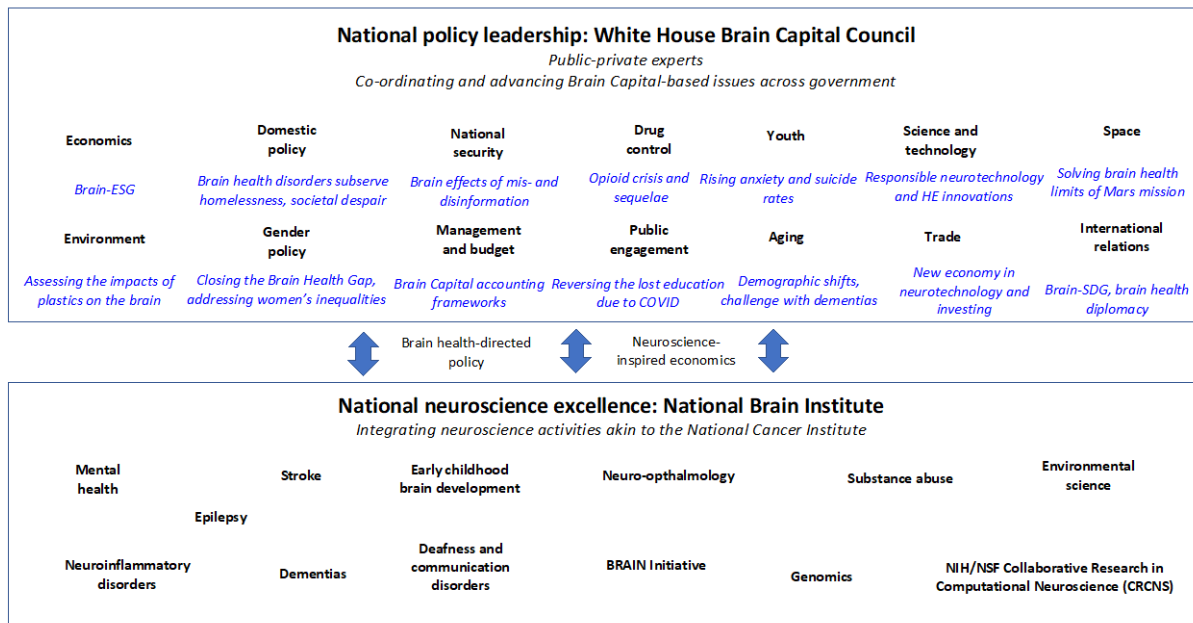
Examples of brain health-directed policy agendas

Approaches for the United States of America	
<p><i>Proposal for a White House Brain Capital Council</i></p>	<p>We recently proposed a White House Brain Capital Council for the United States.⁹¹ This Council would take a whole-of-country approach, integrating the federal government with communities at all levels, engaging partners across the spectrum from small and medium enterprises to patient and caregiver groups, to educators, to health care workers, economists, and beyond. This Brain Capital Council would harmonize with existing task forces, councils, and advisory groups with overlapping remits to not duplicate but rather bolster all efforts related to the building of Brain Capital. Additionally, the need for a <i>National Brain Institute</i> modeled on the successful National Cancer Institute has been proposed. A new brain-focused institute may serve as a national coordinator of brain-based research.</p> <p>This new Institute would not supplant the existing NIH institutes; rather it would better connect, integrate, and build on their work with other NIH institutes and outside industry, finance, tech, education, and health partners. Combining these strategies, a <i>National Brain Capital Strategy</i> (illustrated in Figure 2) can be conceived. This strategy has the potential to effectively link the policy and economic strategies of the White House Brain Capital Council and the proposed National Brain Institute, to ensure neuroscience-based policy and economic agency.</p>
<p><i>Congressional Caucus on Social Determinants of Health</i></p>	<p>In 2021, the bipartisan <i>Congressional Social Determinants of Health Caucus</i> was launched to coordinate federal investments in social determinants of health (SDoH) and social drivers of health such as food, housing, and transportation.¹¹⁰ It seeks to amplify evidence-based approaches to holistic well-being with the support of federal funding. Congressional responsibility in this context is divided among many committees and delivered across multiple agencies. Members of Congress from diverse jurisdictions work to coordinate efforts to improve health outcomes and maximize existing and future federal investments in health, food, housing, transportation, and other SDoH. Leadership is needed to break down the silos and challenges that impede improved coordination between health and social services programs.¹¹¹</p> <p>While the above mentioned SDoH impact mental and cognitive health too, there are also some unique social determinants of mental and cognitive health such as pervasive stigma against MNS disorders, lack of parity in reimbursement for mental healthcare, homelessness, adverse effects of social media, with hurtful communication leading to high stress and suicides, especially among youth,¹¹² and loneliness and social isolation, which are associated with increased risk of alcohol and drug abuse, suicidality, poor nutrition, sedentary lifestyle, poor sleep, and worsening physical functioning.¹¹³ Loneliness and social isolation can be as dangerous to health as smoking and obesity, and are an important risk</p>

	<p>factor for Alzheimer’s disease, major depression, and generalized anxiety disorder, as well as cardiovascular and metabolic diseases.³⁶ There are also positive SDoH including positive childhood experiences, social connections, and community-level resilience, social engagement, and social support, exemplified by movements like Compassionate Communities movement. Reducing barriers to and enhancing facilitators of early detection of dementia can help reduce bio-psycho-social morbidity associated with Alzheimer’s disease and related dementias.^{114,115}</p>
<p>Wisdom and Resilience in-all-policies</p>	<p><i>Wisdom</i> is a critical positive SDoH and a personality trait comprising specific components: empathy and compassion, self-reflection, emotional regulation, acceptance of uncertainty and diversity of perspectives, social decision-making, and possibly, spirituality. Across the lifespan, wisdom is associated with positive outcomes, including better overall physical and mental health, happiness, and lower levels of depression and loneliness.³⁶ Some empirical evidence indicates that wisdom has a curvilinear relationship with age, peaking in the late 70s or early 80s. Neurobiological investigations show that prefrontal cortex (especially dorsolateral, ventromedial, and anterior cingulate), insula, and limbic striatum (especially amygdala) are involved in the various components of wisdom. A number of recent clinical and neurobiological studies have reported a strong inverse relationship between loneliness and wisdom, especially its compassion component.^{36,116,117} These findings suggest potential use of individual- and societal-level interventions to enhance compassion and other components of wisdom so as to reduce loneliness and improve wellbeing.^{117,118} A meta-analysis of interventions that targeted specific components of wisdom identified 57 randomized controlled trials conducted in individuals across the lifespan.¹¹⁹</p> <p><i>Resilience</i> is a trait or outcome that describes recovery or bounce-back from adverse situations or a process of adapting well in the face of adversity, trauma, threats, or other sources of major stress. From a psychological perspective, resilience has also been described as <i>core virtue</i> highly conducive to <i>character strength</i> (i.e., essential for optimal functioning and adaptability as well as achieving difficult goals).¹²⁰ Resilience is highly relevant to healthy aging and well-being, and should be viewed as a public health concept, with efforts to intervene through policy to foster greater resilience by increasing resources available to people in need.^{121,122} As noted by Klasa et al. (2021), “a framework for resilience to the challenges associated with aging is required to complement on-going risk reduction policies, programs and interventions”.¹²³ Resilience interventions include mindfulness training, cognitive behavioral therapy, online webinars, wellbeing therapy, social support, lifestyle and mind-body interventions, and phone coaching.¹²⁴</p> <p>The behavioral pandemic of loneliness, social isolation, opioid abuse, and suicides has contributed to a drop in the average US longevity in 2015-17, for the first time since the mid-1950s.³⁶ The COVID-19 pandemic and the necessary social distancing guidelines have worsened health and healthcare inequities in marginalized groups. The systems of cognitive, mental, and physical healthcare need to be re-engineered to better recognize and respond to SDoH by promoting wisdom and resilience in-all-policies.¹¹³</p>

<p>The Comprehensive Soldier and Family Fitness Program</p>	<p>The United States Army's <i>Comprehensive Soldier and Family Fitness (CSF2) Program</i> provides a model for how resilience and performance science may be integrated into strategic policy.^{125,126} With over one million uniformed members who share a challenging and often dangerous work environment, CSF2 is designed to leverage state of the art of the behavioral and neurosciences to optimize soldier performance, resilience, and adaptability.</p> <p>Yearly assessments of physical and psychological indicators of resilience form the basis of CSF2. Yearly assessments of physical, emotional, social, family, and spiritual well-being provide soldiers with a baseline of their overall resilience. Physical resilience is assessed by yearly medical exams and scores on physical fitness tests. Emotional, social, family, and spiritual fitness are assessed by an online questionnaire, the Global Assessment Tool (GAT). The results of these assessment are categorized as green (optimal), yellow (at some risk), or red (as significant risk). When a soldier presents as yellow or red in one or more categories, they are provided with training options to address weaknesses.</p> <p>In addition, the Army trains thousands of Master Resilience Trainers (MRTs) each year. These MRTs are senior enlisted soldiers who, after completing an intensive 10-day course in how to train resilience skills in others, return to their home units and in turn train the other soldiers on these skills. In this manner, all U.S. Army soldiers receive regular training in physical and psychological resilience. In the same vein, a Human Preventative Maintenance and Service (PMCS) Concept Manual has recently been developed by the US Army as a comprehensive and practical tool for operators/leaders to improve human systems capabilities across multiple domains, including a focus on cognitive skills and brain health (Leaders/Operators Manual For Human, Multi-Domain, Department of the Army, <i>unpublished</i>).</p> <p>Since its inception in 2008, CSF2 has trained millions of soldiers in resilience skills. The GAT has been demonstrated to be a reliable and valid assessment.¹²⁷ Moreover, evidence suggests that CSF2 training protocols are effective,¹²⁸ particularly in training social skills related to resilience. Targeting psychological components of resilience, these skills are equally linked to brain health.¹²⁹ In this manner, CSF2 provides a model for how other large organizations or even nations can develop systematic and science-based policy to improve the brain health of their constituent populations.</p>
<p>The 16-National Control Group Project</p>	<p>Recently, Sterling and Platt (2022) published a study comparing and contrasting US deaths of despair and socio-economic data against those of 16 "control", comparative wealthy nations (including countries in Western Europe, Canada, Australia, and Japan).¹³⁰ These control nations have significantly better mortality outcomes as compared to the U.S. The authors found the control group publicly supports every stage of the life cycle, and these supports in aggregate probably explain the observed lower mortality. They note "<i>public support is provided for prenatal care, maternal leave, preschool care, elementary and high school education, education beyond high school (when our ancestors were learning to hunt and gather), and substantial time off for noneconomic activities</i>".¹³⁰</p>

Figure 2. Schematic illustration of a National Brain Capital Strategy



Other Approaches

Pan-European Approaches

Many initiatives have been undertaken at EU level to foster and support research into neuroscience, particularly in the context of EU Framework Programmes for Research and Innovation, the latest and current version of which is “Horizon Europe.” These initiatives include large-scale programs such as the EU Joint Programme on Neurodegenerative Disease Research,¹³¹ the ERA-net Neuron,¹³² and other smaller endeavors. As part of other programs, additional initiatives did emerge, such as the Human Brain Project¹³³ under the flagship initiatives aimed at developing research infrastructures. In a context of greater policy prioritization and fostered coordination, the European Commission and the EU Member States have included a “Brain Health Partnership” within the development of Horizon Europe, as an attempt to streamline and better focus support and prioritization of funding for brain research.¹³⁴ To accompany this process, an EU-funded project (coordination support action) was initiated to better coordinate action and avoid duplication or fragmentation between existing large-scale initiatives: the European Brain Research Area (EBRA).¹³⁵ In doing so, EBRA did develop its “shared agenda” aimed at defining future priorities, notably in view of the Brain Health Partnership but also, more generally, in the context of Horizon Europe. Once defined, this “shared agenda” will be further disseminated at the global level with an aim to demonstrate the EU’s leadership in the space but also potentially open dialogue and collaborations with other regions of the world.

Importantly, these developments in the research policy space have led to greater recognition and prioritization of both neurological and mental health in the action of the European Commission, in the context of its announced “non-communicable disease initiative” and related funding program “EU4Health.”¹³⁶ With an unprecedented budget allocation for its public health program, the Commission engaged in cross-sectoral consultations with the stakeholder community. In this context, the field of neurology was recognized for the first time and is now included in a common chapter together with mental health. This achievement is to be attributed to the efforts of the European Federation of

Neurological Associations (EFNA) and the European Academy of Neurology (EAN), which had previously joined forces in the context of the “OneNeurology” campaign,¹³⁷ targeting primarily the WHO and its recently enacted *Intersectoral global action plan on epilepsy and other neurological disorders*.¹³⁸

Together, the aforementioned developments build on years of constant advocacy by the community as the concept of a “European Brain Research Area.” Major stakeholders in the field (i.e., patient organizations, scientific societies as well as industry leaders), joined forces in creating the European Brain Council (EBC)¹³⁹ as a platform capable of speaking with one compelling voice to represent the community to EU institutions. For this purpose and since its creation in 2002, the EBC continuously worked towards generating consensus amongst the key stakeholders in the “brain space” (e.g., “Consensus Statement for the priorities in brain research in Europe”), demonstrating the societal impact of the brain and its disorders (e.g., “Cost of Brain Disorders in Europe” and “Value of Treatment for Brain Disorders in Europe”), federating the key players in the innovation ecosystem (e.g. the Brain Innovation Days) or generating new policy initiatives (e.g. EBRA, the Brain Health Partnership and - yet to come - the “NCD initiative”).

Further Regional and Global Approaches

The Australian Mental Wealth Initiative

The *Mental Wealth Initiative* (MWI) at the University of Sydney’s Brain and Mind Centre is a frontier transdisciplinary project aimed at fostering the Mental Wealth of nations and contributing to “*thriving, productive and resilient communities*.”^{65,140} The MWI utilizes systems modelling, simulation, and data science techniques to understand the variables associated with improved population mental health outcomes across the lifecourse.¹⁴⁰ Deliverables include research-driven, evidence-based, and actionable strategies directed at gearing economic and social policies towards maximization of population mental health and wellbeing, as well as development of an “early warning system” for downturns in the Mental Wealth of nations.¹⁴⁰

The United Kingdom Mental Capital and Wellbeing Report

In 2008, the UK Government Office of Science published a report titled “Mental capital and Wellbeing: Making the most of ourselves in the 21st century.”¹⁴¹ This report looked at how a person’s mental resources change through life, as a child, adult and in old age, and identifies factors that can help or hinder their development. It outlined the opportunities and challenges facing the UK over the next 20 years and beyond, and suggests what the government, individuals and businesses can do to meet the challenges ahead.

Davos Alzheimer’s Collaborative

The *Davos Alzheimer’s Collaborative* (DAC) initiated a first-of-its-kind global public-private collaborative linking discovery research, clinical trials, and health system readiness across high-, middle-, and low-resource countries to tackle Alzheimer’s disease (AD) in a new way. Specifically, this initiative comprises a public-private partnership working toward a global response to AD and the challenges it poses to millions of individuals and families globally. The DAC seeks to raise \$700 million to fund a six-year plan to accelerate and diversify innovation in AD-focused research. The three primary components of DAC include a global cohort developed to identify new targets for potential treatments, a global clinical trial support platform to reduce the cost and time to test new treatments in trials and bring them to market and promote healthcare system preparedness to get novel treatments to individuals. The DAC project will enable novel biomarker development, connect global researchers using the data platform provided

	by the <i>Alzheimer’s Disease Data Initiative</i> , and keep people with the lived experience of AD at the center of its efforts.
Latin American Brain health initiatives	The prevalence of neurologic conditions in Latin American and the Caribbean countries (LACs) is higher than that in Europe or the U.S. and is expected to increase by 100-250 percent by 2050. ¹⁴² Factors impacting this alarming trend include social and environmental inequities, negative SoDH, unique genetic profiles of LAC populations, as well as substantial structural challenges such as insufficient integrated health care and development systems, overburdened public health organizations, unstable economic circumstances, a high informal caregiver burden, insufficiently trained specialized healthcare providers, and a limited funding and research infrastructure. ^{143,144} The <i>Latin American brain health institute (BrainLat)</i> was recently created as an innovative, multisectoral, and educational initiative to tackle many of these challenges. ¹⁴³ Launched at the University Adolfo Ibáñez (Chile), BrainLat comprises an international advisory board (60 institutions) and affiliation with the Global Brain Health Institute (GBHI). Regional capacity building is a central agenda of BrainLat, as illustrated by ongoing consortia, including the Latin America and Caribbean consortium on dementia (LAC-CD) ¹⁴⁵ and The Multi-Partner Consortium to Expand Dementia Research in Latin America (ReDLat). ^{143,146} As such, BrainLat aims to establish a holistic approach to brain health-directed policy in the LAC region, fostering integration of care and public systems with research, as well as enabling coordination across private/public sources and local/regional/international stakeholders. ¹⁴³
Misinformation resilience initiatives	A number of programs have been established to promote misinformation resilience. ⁸³ NATO has stressed the necessity for development of effective misinformation resilience programs among international alliances. ¹⁴⁷ Initiatives launched at national level include the United Kingdom’s Rapid Response Unit ¹⁴⁸ to combat fake news and Sweden’s Psychological Defense Agency. ¹⁴⁹ Another recent example is the <i>Business Council for Democracy (#BC4D)</i> : launched in Germany in response to the “COVID-19 infodemic” and jointly led by the Institute for Strategic Dialogue, the Hertie Foundation and the Robert Bosch Foundation, the initiative is directed at strengthening democracy by fostering “digital citizenship education” and misinformation resilience in the workplace. ^{150,151} Counter-influence campaigns in western countries have begun to “pre-bunk” (or inoculate against) weaponized disinformation. ^{83,152} Replication and scaling of such programs including evidence-based identification, and sharing of best practices, is warranted.

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