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Project Report

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Marcel Arnold, Indrit Bègue, Murielle Bochud, Andrew Chan, Kim Q. do Cuénod et al.



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Project Report

# The Swiss Brain Health Plan 2023–2033

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**Abstract:** The brain and its health are essential for our (physical mental, social, and spiritual) wellbeing, for being able to realize our potential as individuals, and also for a fair, well-functioning, and productive society. However, today the world is facing a healthcare crisis related to the very high (and increasing) burden of brain disorders. As a response to this crisis, the “Swiss Brain Health Plan” (SBHP) was conceptualized in the context of other initiatives launched to value, promote, and protect brain health over the entire life course. In the first section of this position paper, the following fundamental considerations of the SBHP are discussed: (1) the high (and increasing) burden of brain disorders in terms of prevalence (>50% of the population suffers from a brain disorder), disability, mortality, and costs; (2) the prevention of brain disorders; (3) the operational definition of brain health; (4) determinants of brain health; (5) international initiatives to promote brain (including mental) health including the World Health Organization (WHO) intersectorial global action plan on epilepsy and other neurological disorders (NDs) (IGAP) and the WHO comprehensive mental health action plan. In the second section of the paper, the five strategic objectives of the SBHP, which has the vision of promoting brain health for all across the entire life course, are presented: (1) to raise awareness; (2) strengthen cross-disciplinary and interprofessional training/educational programs for healthcare professionals; (3) foster research on brain health determinants and individualized prevention of brain disorders; (4) prioritize a holistic (non-disease-specific), integrated, person-centered public health

approach to promote brain health and prevent brain disorders through collaborations across scientific, health care, commercial, societal and governmental stakeholders and insurance providers; (5) support, empower, and engage patients, caregivers, and patient organizations, and reduce the stigma and discrimination related to brain disorders. In the third section of the paper, the first (2024) steps in the implementation of the SHBP, which will be officially launched in Zurich on 22 November 2023, are presented: (1) a definition of the overall organization, governance, specific targets, and action areas of the SBHP; (2) the patronage and/or co-organization of events on such specific topics as brain research (Lausanne), dementia (Geneva), stroke (Basel), neurohumanities (Bellinzona), sleep (Lugano), and psychiatry (Zurich); (3) the conduction of a new study on the global burden of brain disorders in Switzerland; (4) the launching of an international Certificate of Advanced Studies (CAS) on Brain Health at the University of Bern. In the fourth section of the paper, there is a concise executive summary of the SBHP.

**Keywords:** brain health; World Health Organization; promoting brain health

## 1. Introduction

Our brain plays a crucial role in all aspects of our life; it is essential for cognitive, motor, and sensory functions, as well as our experiences, emotions, and behavior. In addition, it influences vascular, endocrine, and immunological processes in our body. Eventually, the brain and its health are essential for our individual (physical mental, social, and spiritual) wellbeing, for being able to unlock our potential (in terms of knowledge, skills, and creativity) as individuals, as well as for the sustainable development of a fair, well-functioning, and productive society [1].

The key role of a healthy brain in our life stands in contrast to the limited awareness among the public and health professionals regarding the very high burden of brain disorders (see Appendix A.1), the growing possibilities to diagnose, treat, rehabilitate, and prevent them, and the opportunities to promote brain health and resilience throughout the entire lifespan [2–4]. Brain disorders, both MDs and NDs, affect millions of people worldwide. According to the World Health Organization (WHO), and recent peer-reviewed publications, more than one in three persons are affected by a ND and at least one in three are affected by a mental (psychiatric) disorder (MD) [3–6].

Until today, brain health and brain disorders have often been neglected, particularly concerning prevention strategies and compared to other non-communicable diseases. Accordingly, most countries lack brain health education and promotion policies. The prevention of brain disorders is underprioritized, under the presumed outdated assumption that little can be done to reduce individual and population risk [4]. Moreover, there is a significant shortage of healthcare professionals worldwide for diagnosing and treating brain disorders, including in several European and other Western, high-income countries [7–10]. Finally, research, teaching, and public awareness on brain disorders and brain health remain markedly underfunded [11].

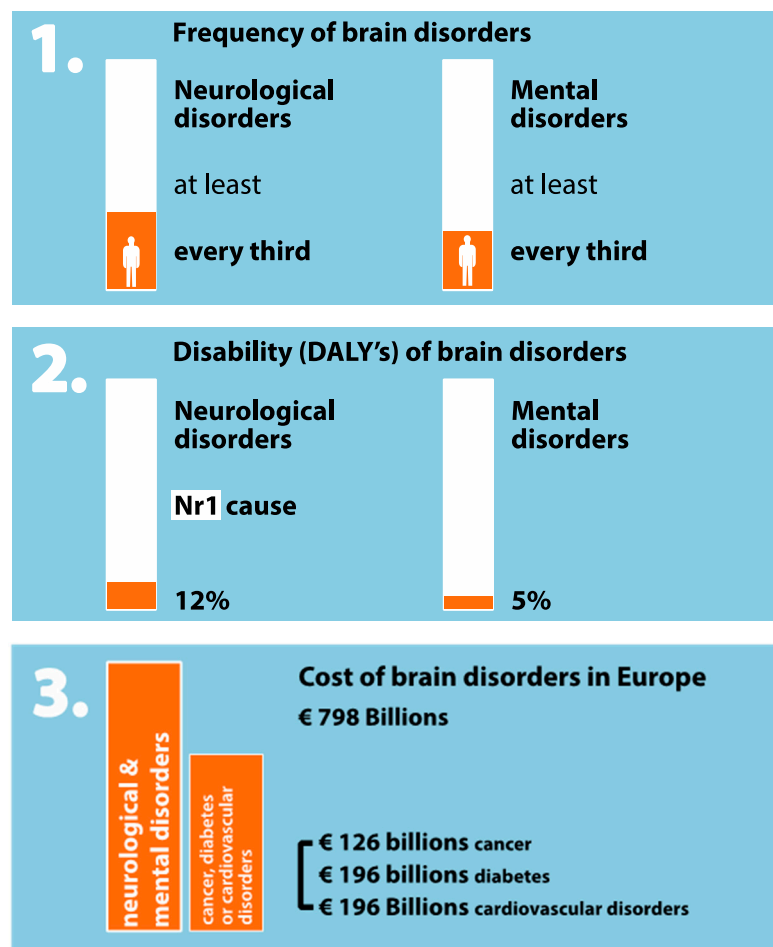
Brain health, which includes mental health [12], can be conceived as a public good in which a coordinated collective financial, material, and cultural investment carries the potential for significant societal benefits for both present and future generations.

This paper, which represents the work of a consortium of almost 60 clinicians and scientists across multiple disciplines and career stages within the country, presents the data, conceptual framework, and considerations upon which the initiative is built, along with the first concrete measures to implement a National Plan to promote Brain Health for all and across the entire life course in Switzerland (SBHP) [13].

## 2. Section 1: The Fundamental Considerations of the Swiss Brain Health Plan

### 2.1. The Burden of Brain Disorders

For different reasons, the prevalence and burden of brain disorders have been underestimated for a long period of time [14,15]. The first large study was performed in 30 European countries in 2010, included 9 neurological and 10 mental disorders, and estimated that in that year, >50% of people living in Europe had a brain disorder for a total estimated cost of EUR 798 billion (of which 63% were indirect costs). These costs exceeded the estimated costs of cardiovascular disorders, cancer, and diabetes, and represented 45% of the annual health budget of Europe (Figure 1) [16,17].



**Figure 1.** The burden of brain (neurological and mental) disorders. A direct comparison of the economic burden across different disorders is possible only with data dating from a decade ago [2,3,5,16,18–20] (Figure: Alain Blank, Bern).

### 2.2. The Burden of Neurological Disorders

It is only in the last decade that the burden of NDs including dementia, stroke, epilepsy, headache, Parkinson's disease, multiple sclerosis, sleep-wake disorders, brain tumors, traumatic brain injury, and neuromuscular and rare diseases has been appropriately studied and fully recognized (Figure 1) [16,21].

The prevalence of NDs in the general population was estimated in two recent systematic reviews of studies conducted in Europe and worldwide to be over 30% [2,3,22]. These studies also found that NDs are the leading cause of disability (expressed in so-called DALYs—disability adjusted life years—which refer to years of healthy life lost to premature death and disability), and the second (worldwide) and third (Europe-wide) leading cause of death (Figure 1) [2–4]. The proportion of global DALYs attributed to NDs was estimated in 2016 to be 11.6% [22]. The three largest contributors to disability in 2016 were stroke

(42%), migraine (16%), and dementia (10%). Migraine, multiple sclerosis, and tension-type headache were more common and caused more of a burden in females. Children from underprivileged households, ethnic minorities, refugees, and migrants were disproportionately affected [23].

The burden of NDs has increased from 1990 to 2016 (39% more in terms of disability; 15% more in terms of mortality) [2]. This increase is in part due to the increasing age of the population but it might also suggest that the primary prevention strategies (e.g., for stroke) are still insufficient in terms of effectiveness or implementation [2]. The COVID-19 pandemic has been exacerbated by multiple neurological complications with a consequent increase in the burden of NDs [24,25].

The European Academy of Neurology (EAN) is currently completing an in-depth analysis on the costs of 18 NDs across 47 European countries (including Switzerland), which is expected to be published in 2024. Recent studies have estimated the global societal costs of single NDs such as dementia (equivalent to 1.5% of the global GDP) and sleep disorders (between 1.3% and 2.9% of the GDP across five OECD countries) [23,26].

### 2.3. The Burden of Mental (Psychiatric) Disorders

MDs are defined in the two major classification systems (DSM-5-TR and ICD-11) as disorders of thought, emotions, and behaviors that impair functional abilities and relationships with others, and are associated with suffering.

The prevalence of MDs was estimated to be around 30% in two studies conducted in Germany and worldwide [5,6]. In 2019, the proportion of global DALYs attributed to MDs was estimated to be 4.9% [5]. Depression was the leading cause of disability due to MDs. An important characteristic of MDs is their common onset in the first half of life, affecting a growing number of young people [27].

Recent studies indicate that the incidence of MDs has increased over the past two decades, specifically in adolescents and adults aged <55 years [5,28]. The COVID-19 pandemic has been marked by numerous psychiatric complications including a 28% increase in major depressive disorders and a 26% rise in anxiety disorders [24,29].

Finally, the mortality of MDs is non-negligible and includes over 800,000 annual suicides worldwide [30] and deaths related to poor health behaviors or substance abuse. Notably, among young people 15–29 years of age, suicide is the second leading cause of death globally [30]. As a consequence, patients with severe MDs have a reduced life expectancy of up to 25 years compared to that of the general population [31].

### 2.4. The Burden of Brain (Neurological and Mental) Disorders in Switzerland

The burden of brain disorders in Switzerland has been estimated by the 2010 European Brain Study, which included 19 brain disorders [16]. This study suggested that 5.7 of the 7.8 million people living in Switzerland in 2010 had a brain disorder. The total costs of care of brain disorders were estimated to exceed 14.5 billion/year [16,32].

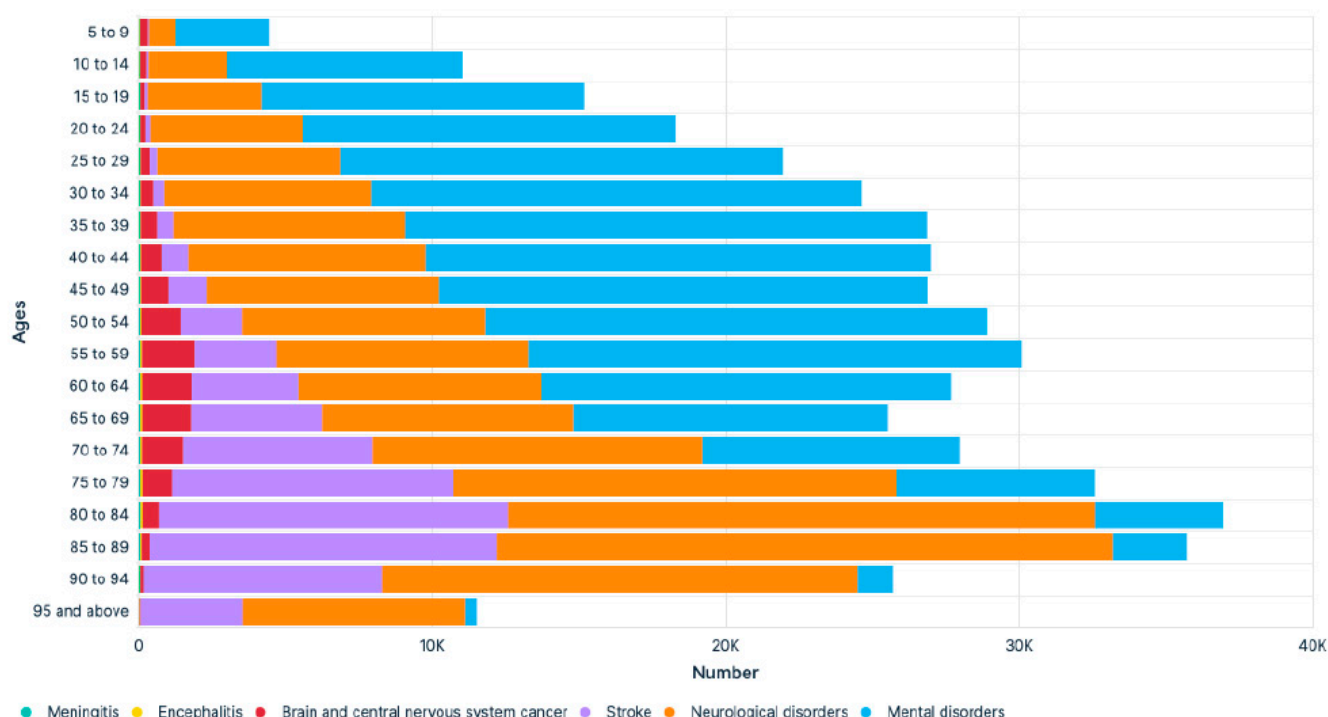
A subsequent analysis devoted specifically to the burden of NDs in Switzerland estimated that in 2010, the nine NDs included in the analysis affected over 3.3 million people with the following prevalence: headache (2,359,744 persons), sleep disorders (682,598), dementias (124,218), stroke (71,156), epilepsy (38,150), Parkinson's disease (17,624), multiple sclerosis (7669), neuromuscular diseases ( $n = 3894$ ), and brain tumors (3504). For some of these NDs (e.g., multiple sclerosis; sleep disorders), specialists estimate that these prevalences are/were even higher.

In addition to these common NDs, there are around 600,000 individuals affected by rare diseases (defined as a prevalence of <5 per 10,000 inhabitants) in Switzerland, many of which can lead to a wide range of neurological symptoms.

The Brain Health Atlas initiative (<https://brainhealthatlas.org> (accessed on 12 October 2023)), estimated the DALYs for Switzerland in 2021 (<https://brainhealthatlas.org/factsheet> (accessed on 12 October 2023), see also Figure 2). The most important results can be summarized as follows: (1) The estimated burden of brain disorders varies significantly



across age groups. While the age group of 80–84-year-olds was estimated to experience the largest number (35,085) of brain disorder DALYs in 2019 [33], the burden of brain disorders is also non-trivial among Swiss children, with a relevant impact already in children aged 10–14 (10,749 DALYs), and rising very significantly among adults aged 35–39 (26,642 DALYs); (2) Disability in NDs exceeded that in MDs by more than 25%. Headache disorders (including both migraine and tension-type headaches) cause the highest age-standardized rates of health loss related to brain disorders in Switzerland, as it is the case for many other European countries. This burden is driven by a large and increasing prevalence; (3) One large driver of DALYs across all ages, not only the elderly, is represented by depressive disorders. Approximately 391,056 Swiss people were living with depressive disorders in 2019, representing an increase of 4% from the number in 1990 [33].



**Figure 2.** The disability related to brain disorders in Switzerland in 2021. The disability, as expressed in the years of healthy life lost (DALYs), due to different brain disorders varies across the life course and reaches the highest value at the age of 80–84 (data from the “Brain Health Atlas”, <https://brainhealthatlas.org> (accessed on 12 October 2023)). Noteworthy, in this representation, stroke, meningitis/encephalitis, and brain/central nervous system cancer are listed separately from other neurological disorders.

### 3. Prevention of Brain Disorders

In recent decades, neurology has evolved from a predominantly diagnostic to an increasingly therapeutic discipline [34,35]. Psychiatry has a longer tradition of treatment combining such approaches as psychotherapy, psychopharmacology, and non-invasive brain stimulation. While an increasing number of patients with brain disorders can be treated efficiently and benefit from favorable outcomes today, disease-modifying drugs and effective interventions are still insufficient (for 30% of patients with depression and most patients with neurodegenerative disorders) [8,36,37].

As a consequence, both universal and selective prevention are essential to reduce the burden of brain disorders, and should be grounded on the promotion of brain health, which in turn is rooted in brain health education (significantly, only a few sentences are devoted to the topic of “prevention of brain disorders” in standard German-language texts on social and preventive medicine [38,39]). The recent establishment of an interdisciplinary unit for the treatment and prevention of dementia at the Geneva University hospital (unité de

traitement et de prevention des démences”) documents the growing demand for preventive brain medicine in Switzerland.

Preventive neurology and psychiatry are relatively new disciplines but are increasingly based on scientific evidence [40,41]. Recent studies have estimated that up to 25% of epilepsies, 40% of dementias, and over 50% of strokes could be prevented through potentially attainable relative reductions (by up to 20% less) in the prevalence of modifiable risk factors [4,42,43]. For most brain disorders, however, risk factors and determinants remain poorly known [2].

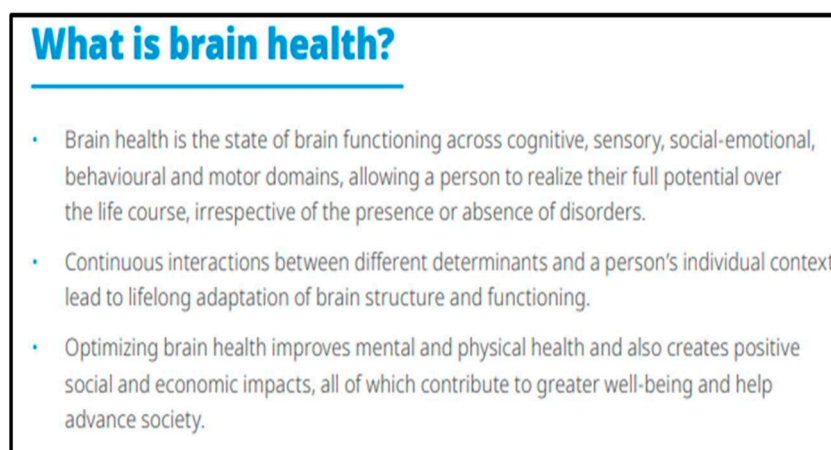
Because most risk and protective factors tend to cluster and co-occur, and are modulated by social determinants, cultural, and contextual circumstances, both individual- and population-level approaches are required to reduce risks, and also to pursue prevention through the timely detection of prodromal signs and symptoms, and of pathological hallmarks in individuals. Timely and early detection/diagnosis is important because evidence suggests that early, complex, multidomain interventions can effectively contribute to buffering and delaying the clinical manifestations and effects of brain damage. Furthermore, personalized medicine approaches, which tailor prevention and treatment based on individual risk profiles and monitor risk in specific population subgroups, hold significant potential. They can not only enhance the effectiveness of interventions but also promote sustainability, improve adherence, and ensure fidelity among target groups, health-care professionals, and all stakeholders involved in implementing prevention programs and strategies.

#### 4. Brain Health: Definition and Relevance (“No Health without Brain Health”)

The WHO definitions of health (1948) and mental/psychological health (Mental Health, 2004) are well established, although still somewhat debated. A unifying and widely accepted definition of brain health was lacking until very recently [44–46]. While until 2005, fewer than 10 papers per year were published on the topic of “brain health”, in 2021, there were already more than 1800 [4]. Several suggestions for a definition of brain health have been published in the last 10 years [1].

Traditionally, a distinction was made between “mental health” and “brain health” on the one hand, and between NDs and MDs on the other. This dichotomy is misleading; etiological/pathophysiological overlaps are present across brain disorders and in clinical practice (e.g., in the context of the neuropsychiatric complications of COVID-19 disease or in the context of post-COVID syndrome [47]), the separation is often not possible or does not make sense [4,12,21].

On 9 August 2022, the WHO presented the position paper “Optimizing brain health across the life course”. It proposed a new definition (Figure 3) [4].



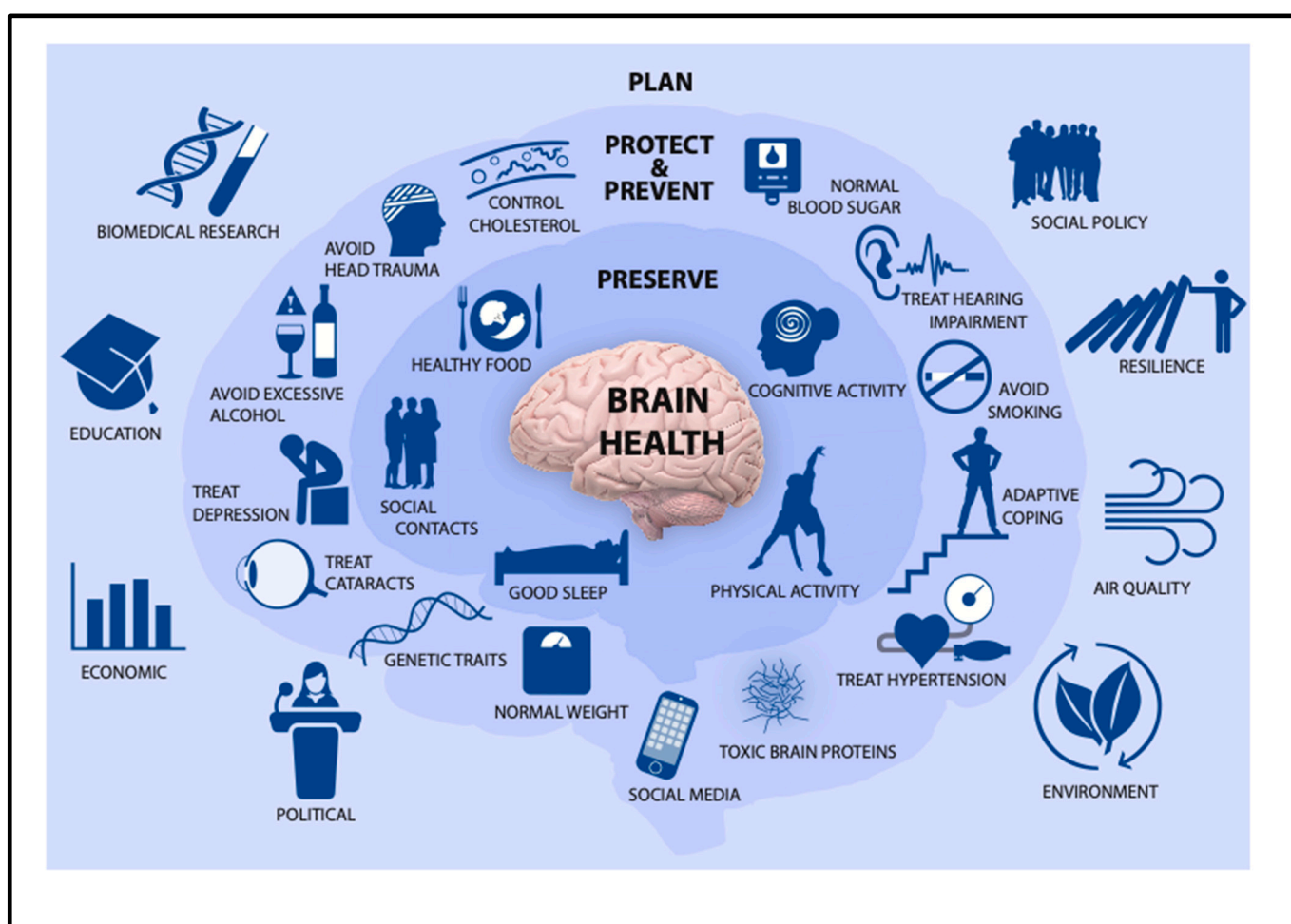
**Figure 3.** WHO definition of brain health.



This new holistic, person-centered definition advocates for stronger multi-sectoral and interdisciplinary collaborations in social and health systems to maximize prevention, treatment, rehabilitation, care, and the participation of patients and their families/caregivers. However, brain health goes beyond the absence of disease—it defines a state that is essential for wellbeing, productivity, creativity and coping with life stressors (“no health without brain health”). At the same time, brain health is an important component of mental health, which is why brain health prevention measures can improve many diseases. Often considered separately, both NDs and MDs depend on brain health, on its optimal prenatal and postnatal development, and on its structural and functional maintenance across the life course.

### 5. Brain Health: Determinants

Numerous factors across the life course (from the prenatal stages to old age) contribute to determining and influencing brain health (Figure 4).



**Figure 4.** Factors that determine brain health throughout the lifespan (figure modified by Alain Blank, Bern, from Bassetti et al., 2022 [2]). Preserve: behaviors and factors that promote brain resilience (see also Appendix A.2). Protect/prevent: factors that decrease brain resilience (see also Appendix A.2).

Brain health and resilience (i.e., the ability to respond to structural and functional damage) are influenced by various factors, many of which are part of our daily lives. These factors include age, sex/gender, socio-economic factors, sleep, diet and food systems, physical activity, cognitive (mental) activities, social adversity, and numerous risk factors including overweight/obesity, hypertension, diabetes, hyperlipidemia, addictions (alcohol,

tobacco-related products, and specific drugs such as heroin and opioids), and genetic variation [1,4,21,48].

Other factors including education, hearing loss, visual impairment, traumatic brain injury, air pollution, excessive use of social media, weather, and other environmental factors including the built (e.g., housing, school, and workplace) and natural environment (e.g., green and blue space; the climate) may also influence our brain health [49–51]. Other more global and recently identified factors include commercial and legal determinants of health which may also impact brain health broadly and at a very upstream level [52,53].

The key to achieving optimal brain health lies ideally in adopting a holistic approach that encompasses all these factors. Interventions to promote brain health may vary from including very general and population-based to more specific (targeted) individual-based measures. Individualized and multi-domain strategies will require appropriate information, communication, motivation, and a consideration of individual values [48,54].

The WHO identifies five determining factors (physical health, healthy environments, safety and security, learning and social connection, and access to quality services) for brain health [4].

The European Academy of Neurology (EAN) has grouped risk and protective factors into the following three categories [21]: (1) preservation (see Appendix A.2): e.g., a healthy diet, good sleep, social interactions, and physical activity (see above); (2) protection: e.g., from excessive alcohol consumption, brain injury, addictions (see above), high sugar consumption, high blood lipids, and high blood pressure (see above); (3) planning: e.g., political, scientific, and public health decision-makers influence access to education, the environment, research strategies, and socio-economic conditions, which (as the COVID-19 pandemic and the invasion war against Ukraine illustrate) influence our brain and mental health [55].

A precise identification of the determinants of brain health and risk factors in brain disorders is essential for interventions at the societal and individual level. While major advances have been made in the targeted (precise) prevention of dementia and stroke [43,56,57], our understanding of risk factors and determinants for most (other) NDs and MDs remains limited [2].

More research is required for the effective prevention of many brain disorders [2,58]. Promising new approaches to foster brain health and the prevention of brain disorders include immunotherapies for dementia and demyelinating disorders, genetic approaches for neuromuscular disorders and rare diseases, and the promotion of neuroplasticity (e.g., cognitive training and sleep) to improve cognitive resilience. The identification of novel (e.g., neurophysiological, neuroimaging, and omics-related) biomarkers and the use of new technologies (e.g., brain-machine interfaces and digital health technologies) are also expected to contribute to brain health.

## 6. International Initiatives to Promote Brain Health

### 6.1. Neurological Disorders

In recent decades, several initiatives have been launched to promote the better care and prevention of single NDs including stroke and epilepsy [59,60].

The years 2020–2022 marked a paradigm shift, leading to the recognition of the importance of brain health “as a whole” and across the entire spectrum of NDs [61]. Of note is that in 2020, the World Health Organization (WHO) established a dedicated unit for “brain health” and created an intersectoral Global Action Plan (IGAP) on epilepsy and other neurological diseases [23]. This plan was adopted by the World Health Assembly on 27 May 2022. Its aims are to “improve the care, recovery, wellbeing and participation of people with neurological conditions across the life course”. The IGAP provides a comprehensive roadmap of actions for member states, international partners, and intergovernmental agencies to optimize brain health (see Table 1). With this global action plan, the WHO defines neurological diseases for the first time as a public health priority for which the member states are expected to define national action plans. This is a turning point

because health policies and plans provide the foundation for concerted actions to define attainable, and actionable goals, as well as the associated implementation steps, targets, and indicators to monitor progress.

The European Academy of Neurology (EAN) launched several activities in recent years to support the preparation and promote the approval of the intersectoral Global Action Plan of the WHO (see below). The year 2022 saw also the publication of the EAN landmark policy paper (“Brain Health: One Brain, One Life, One Approach”) and the organization of a “Brain Health Summit” (<https://vimeo.com/705339023#t=13min06s> (accessed on 12 October 2023)) attended by multiple European stakeholders including Dr. Valek, Minister of Health of the Czech Republic (which secured the Presidency of the EU Council in the second half of 2022) [4]. A second summit was organized by the EAN in 2023.

**Table 1.** WHO intersectoral Global Action Plan on epilepsy and other neurological disorders, 2022–2031 (adopted by the WHO Assembly in May 2022) [23].

The following five factors are essential for brain health: physical health, healthy environments, safety and security, learning and social connection, and access to quality services.

A. Strategic objectives

- (1) Raise the prioritization and strengthen governance;
- (2) Provide effective, timely, and responsive diagnosis treatment and care;
- (3) Implement strategies for promotion and prevention;
- (4) Foster research and innovation and strengthen information systems;
- (5) Strengthen the public health approach to epilepsy.

B. Guiding principles

- (1) People-centered primary health care, and universal coverage;
- (2) An integrated approach of care across the life course;
- (3) Evidence-informed policy and practice;
- (4) The empowerment and involvement of persons with neurological disorders and their carers;
- (5) Gender, equity, and human rights.

In its 2023 Strategic Neurological Research Agenda for Europe, the EAN has listed Brain Health as a key priority [58].

The European Federation of Neurological Associations (EFNA), which brings together European umbrella organizations of neurological patient advocacy groups to work with other associations in the field of neurology, was launched with the support of the EAN and other stakeholders of the “One Neurology” initiative, which was very important in the preparation and eventual approval of the IGAP [21,61].

The World Federation of Neurology (WFN) dedicated World Brain Days in 2022 and 2023 to the theme of brain health [62].

### 6.2. Mental (Psychiatric) Disorders

The WHO Comprehensive Mental Health Action Plan 2013–2030 builds upon its predecessor and sets out clear actions to promote mental health and wellbeing for all, to prevent mental health conditions for those at risk and to achieve universal coverage for mental health services. The action plan includes four major objectives: more effective leadership and governance for mental health; the provision of comprehensive, integrated mental health and social care services in community-based settings; the implementation of strategies for promotion and prevention; and strengthened information systems, evidence, and research [63]. Another important part of WHO’s global mandate is that devoted to a reduction in the harmful use of alcohol [64].

### 6.3. Brain (Neurological and Mental) Disorders

The European Commission launched the Healthier Together—EU Non-Communicable Diseases Initiative (EU NCD Initiative) in 2022 to support EU countries in identifying and implementing effective policies and actions to reduce the burden of major non-

communicable diseases (NCDs) and improve citizens' health and wellbeing [65]. The initiative covers the period 2022–2027 and includes five strands: (1) a horizontal strand on shared health determinants, focusing on population-level health promotion and the disease prevention of NCDs (complementing the actions of Europe's Beating Cancer Plan); (2) diabetes; (3) cardiovascular diseases; (4) chronic respiratory diseases; and (5) mental health and NDs. These areas were prioritized because of their significant health, societal, and economic burden. Actions on cancer, a pivotal NCD, are covered in Europe's Beating Cancer Plan. While the strands enable us to address the challenges of each disease group, the initiative as such promotes a holistic and coordinated approach to prevention and care.

The European Brain Council (EBC) has launched several initiatives to advocate for patients with brain disorders and to promote more research on brain disorders and brain health; specifically, 17 initiatives have been launched, including a policy roadmap on brain health ([https://www.braincouncil.eu/wp-content/uploads/2021/03/EBC-Policy-Roadmap\\_FINAL.pdf](https://www.braincouncil.eu/wp-content/uploads/2021/03/EBC-Policy-Roadmap_FINAL.pdf) (accessed on 12 October 2023)), a shared European Brain Research agenda (<https://www.ebra.eu/sebra/> (accessed on 12 October 2023)), and the organization of a summit in New York in September 2023, in light of the 78th Session of the UN General assembly, and has called for action and joint activities to promote brain health worldwide [66].

## 7. Section 2: The Swiss Brain Health Plan

Several national organizations (e.g., in Norway, Germany, Uruguay, and the USA [67]) have recently launched brain (health) plans. In Norway and Uruguay, the plans are rooted within the respective ministries and have been adopted by the National Parliament (TD; personal communication).

The Swiss Federation of Clinical Neurosocieties (SFCNS), which since 2009 has advocated nationally with “one voice” for patients with brain disorders [68], published in 2022 a “call for action” to conceive, design, and launch a national brain health plan actively involving all relevant stakeholders including experimental neurosciences (represented by the Swiss Society for Neuroscience), patient representatives, and organizations, health and academic organizations and insurance providers [13].

Following the publication of the “call for action” in 2022, the SFCNS has developed the vision of promoting brain health for all across the entire life course, prioritizing a holistic (i.e., non-disease-specific), integrated, person-centered public health approach and fostering collaborations across scientific, health care, commercial, societal, and governmental stakeholders and insurance providers. Strategic objectives of the Swiss Brain Health Policy encompass raising awareness, better training/education of healthcare professionals, fostering research on determinants of brain health (and more generally on brain disorders), and the promotion of a comprehensive public health approach to brain health and brain disorders. The SBHP plans to create synergies and collaborations with other existing or arising similar national and international networks (see above).

The five objectives of the SBHP are depicted in Figure 5 and detailed in the following paragraph.

- (1) To raise awareness about brain health and the burden of brain disorders.

Brain health literacy among the general population, which still has limited knowledge of the subject [69], but also among physicians and health professionals, needs to be promoted. To be better informed and educated about the possibilities to attain optimal, maintain, and promote their own brain health and to de-stigmatize brain disorders, brain health and the prevention of brain disorders should be routinely integrated into public policies and working programs on prevention and health promotion and across non-health policies and sectors, consistent with the framework of the UN Sustainable Development Goals (SDGs).

Awareness should also be improved concerning the burden of brain disorders (including those in children, which have a tremendous impact on their subsequent adult lives). Brain disorders are highly prevalent (recent estimates suggest that they may affect

up to 50% of the Swiss population; see above), and are markedly burdensome for those who are affected, their family, and society at large. Improved awareness can also substantially contribute to collective, informed advocacy, and eventually leads to specific support activities [7–10,70,71].

- (2) To strengthen the cross-disciplinary and interprofessional training/education of healthcare professionals.

The education and training of physicians, nurses, and other health professionals should emphasize the importance of brain health and raise awareness, knowledge, and understanding about the burden of brain disorders (NDs/MDs). New and dedicated tools to promote cross-disciplinary interprofessional education should be developed. A certificate of Advanced Studies (CAS) on Brain Health will be launched by the University of Bern in Fall 2024 (see below).



**Figure 5.** The 5 strategic objectives of the Swiss Brain Health Plan.

- (3) To foster research on brain health determinants and the individualized prevention of brain disorders.

The knowledge about brain disorders, determinants of brain health, and the precise/individualized prevention of brain disorders is still incomplete (see above) [58,72,73]. Real progress in diagnosing and treating brain disorders will only come from an understanding of the human pathophysiology at the most basic level, from mechanistic studies in animal models, and from developing new tools for combatting that pathophysiology [73]. However, research on brain disorders (and their prevention) is generally underfunded as evidenced by several studies [74,75]. With novel scientific and methodological advances including artificial intelligence (AI), precision brain medicine will lead to the better prediction, prevention, and individualized treatment of brain disorders.



Switzerland needs to support more brain research and promote targeted activities, which could include the following: (A) In-depth/new studies could be conducted on the burden of brain disorders in Switzerland, based also on the collection of reliable data. These are lacking for most brain disorders (NDs and MDs) in Switzerland and should be considered a high priority for public health funding. In the future, the financial burden of brain disorders should include not only direct and indirect costs but also the loss of income for patients, families, and caregivers. (B) Interdisciplinary research integrating behavioral sciences as well as healthcare and health systems research could define how to raise awareness, promote healthy behaviors, and achieve the cost-effective delivery of treatment and care for patients with brain disorders. Action and dissemination plans and information sessions should also be planned to better inform the wider public about the key role of basic (including animal experimentation), translational, and clinical research data to guide a sustainable SBHP. (C) A research program and funding dedicated to brain health could be established to coordinate research and increase the impact of studies, e.g., a SNSF NRP on brain health. Linked to strategic objective 1, action plans and information sessions should also be planned to better inform the wider public about the relevance of basic (including animal experimentation) and translational research for a sustainable SBHP that evolves along the most recent scientific insights.

- (4) To prioritize a holistic and concerted (synergistic) public health approach to promote brain health and prevent brain disorders.

Currently, the promotion of brain health at local, national, and international levels is highly fragmented. The consequence is a multiplication of isolated efforts, a waste of resources and as a result an insufficient impact.

In Switzerland, additional challenges in the promotion of brain health and prevention of NDs and MDs are the lack of a federal prevention law (an initiative in 2012 was rejected by the council of states), and the limited federal support for prevention (less than 3% of the entire national health costs in 2019) [76]. In fact, national strategies for prevention are rare in Switzerland.

The health crisis related to brain disorders and the promotion of brain health require a comprehensive, holistic, and concerted (synergistic) public health approach which is well conveyed by the motto “One brain, one life, one approach” [21]. This approach should include individual-, societal-, and global-level responses and the promotion of collaborations across scientific, health care, commercial, societal, and governmental stakeholders and insurance providers. Good interaction and coordination with existing initiatives on non-communicable disorders and mental health must be guaranteed. All collaborations should be guided by principles of gender perspective, equity (“no one left behind”), and human rights [23].

Concerted actions are needed to improve collaborations of neurologists, psychiatrists, and other specialists concerned with brain disorders with general practitioners, public health specialists, other health professionals, patients, relatives, and caregivers [8,40]. New models of care linking primary, secondary, and tertiary prevention are necessary and could include interdisciplinary services including the use of new technologies/digital tools and approaches, which should also be tested [60].

At the community level, education and training programs on healthy lifestyles promoting brain health and the prevention of NDs and MDs should be offered, starting early in life (e.g., schools) through to primary, secondary, tertiary, and continuing education. Curricula should be evidence-based and provide interactive opportunities tailored to diverse target population subgroups.

Current and future needs can be addressed through specialized outpatient clinics and brain health services, and centers designed around specific needs and gaps and taking advantage of the increasing options offered by precise medicine interventions. Brain health literacy in the general population is insufficient (see above) and should be strengthened. This will promote positive attitudes and behavioral changes in individuals,



and a better adoption of evidence-based policies and strategies, and related population-wide interventions and actions.

(5) To support, empower, and engage patients, caregivers, and patient organizations

The support, empowerment, and engagement of patients affected with brain disorders, and their caregivers (often females [1]), is insufficient. The involvement of patients' organizations is also often limited. Patients and families (often female members bear the majority of the burden) face not only an important emotional and economic burden but also suffer from a lack of information, support, and assistance. What is more, they are often silent, silenced, and stigmatized (with so called second-hand stigma), and may be discriminated because of the stigma associated with brain disorders.

The implementation of SBHP will occur with the contribution and participation of representatives of patients, caregivers, and patient organizations. Specific initiatives and measurable targets need to be defined to improve the information, engagement, motivation, and wellbeing of patients with brain disorders, their families, and caregivers. Initiatives to expand social and financial benefits (e.g., pensions; flexible work hours) will also be discussed.

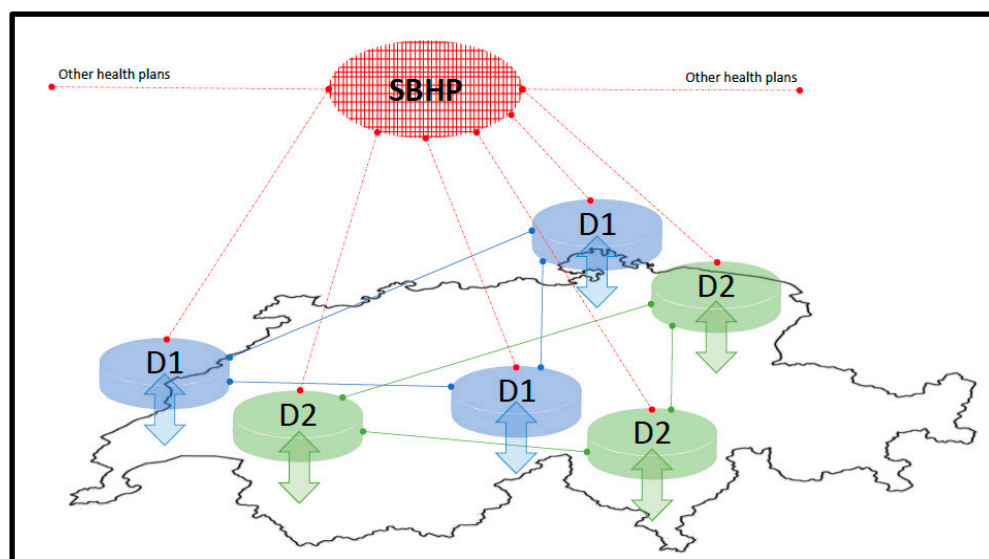
### 8. Section 3: The Next Steps in the Implementation of the Swiss Brain Health Plan



The SBHP will be officially launched in Zurich on 22 November 2023. The first steps in the implementation of the SBHP will include the following activities:

(1) A definition of the overall organization, governance, specific targets, action areas, communication, and evaluation concepts of the SBHP. The recommendation of the IGAP will guide the preparation of the SBHP. Collaborations with other national and global initiatives (including those of the EAN, EBC, EFNA, and WHO) are considered crucial and will be searched for actively. The SFCNS will organize specific meetings in 2024 to discuss the implementation of the SBHP and define specific targets and measures.

While the exact organization of the SBHP still remains to be defined, a three-tier structure of the local (mainly primary), regional (mainly secondary), and national (mainly coordinative) prevention of brain disorders and promotion of brain health is currently envisaged (Figure 6).

At the national level, it will entail the promotion of cross-disciplinary and interprofessional synergistic activities and the appropriate engagement of health professionals, researchers, patients, patients' and caregivers' organizations, and other relevant stakeholders (including those involved in other health plans). The community-based intervention would be secured by family physicians and other primary care health professionals. The regional/secondary intervention should be delivered by specialized regional units (divisions, centers, and departments) involved in the prevention and management of specific (e.g., stroke, dementia, head trauma, anxiety, depression, and neurorehabilitation) brain disorders. These units should deploy disease-specific protocols for risk assessment, prevention, and care, and work in synergy with primary care providers. At the Neurology Department in Bern, a Brain Health Clinic ([www.neurologie.insel.ch/de/unsere-angebote/brain-health](http://www.neurologie.insel.ch/de/unsere-angebote/brain-health)) (accessed on 12 October 2023) was inaugurated in Summer 2023 to promote collaboration between the different specialists and general physicians in the prevention of brain disorders.

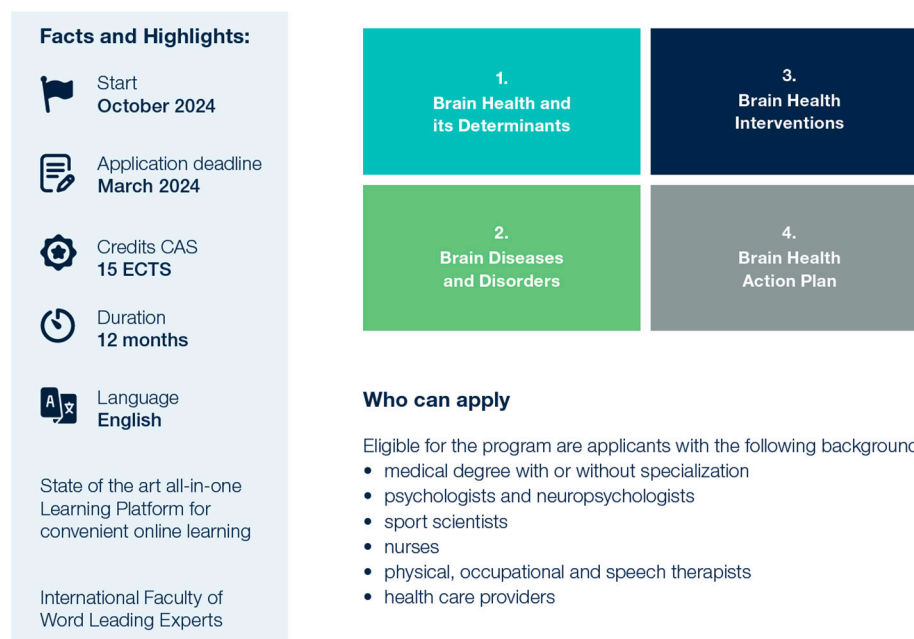


**Figure 6.** Three-level organization in the implementation of the Swiss Brain Health Plan. **SBHP:** Swiss Brain Health Plan of the Swiss federation of Clinical Neurosocieties (SFCNS), promoting at the national level the implementation of the strategic objectives and collaboration with other national health initiatives. **D1/D2:** Regional (e.g., departments, neurocenters, and clinics) organizations delivering specialized care (including targeted primary and secondary prevention) for specific brain disorders (stroke, dementia, and depression) and interactions with primary care providers (including primary prevention).   Interaction between the regional neuro-organizations and the primary care level. New models of care linking primary, secondary, and tertiary prevention are needed to promote brain health in healthy subjects and in patients with brain disorders and to coordinate interactions between the different stakeholders at local, regional, and national levels.

(2) The patronage and/or co-organization of events on specific brain topics such as brain research (7.2.2024, organizer: Swiss Society of Neuroscience, Lausanne, Switzerland), dementia (8.2.2024, Geneva, Switzerland), neurohumanities (26.4.2024, organizer: Sir John Eccles Foundation, Bellinzona, Switzerland), stroke (15–17.5.2024, organizer: European Stroke Organization, Basel, Switzerland), sleep (3.10.2024, organizer: European Sleep Foundation, Lugano, Switzerland), and psychiatry (6.11.2024, Zurich, Switzerland). Additional events with patients' and caregivers' organizations are currently in discussion.

(3) An in depth/new analysis of the global burden of brain disorders in Switzerland will be performed in collaboration with the Institute for Health Metric and Evaluation (IHME) of the Washington University in Seattle, WA, USA.

(4) In Summer 2024, an international Certificate of Advanced Studies (CAS) on Brain Health will be launched at the University of Bern (Figure 7). This CAS in English will be virtually accessible to national and international attendees. In-depth knowledge and skills related to the maintenance and promotion of brain health and the prevention of brain disorders will be offered. An international faculty will provide interactive online lectures on a state-of-the art all-in-one interactive learning platform.



**Figure 7.** The Certificate of Advanced Studies on Brain Health of the University of Bern.

#### 9. Section 4: Concise Executive Summary of the Swiss Brain Health Plan (SBHP)

The SBHP is a comprehensive initiative in Switzerland to promote brain health and the prevention of brain disorders across all stages of life. More awareness, education, and research about the burden of brain disorders, brain health, mechanisms of brain disorders, and opportunities for their prevention are needed. In addition, the SBHP aims at establishing a person-centered, integrated, coordinated, and cost-effective public health approach based on novel and strong synergies between healthcare professionals, scientists, patients, caregivers, insurance providers, and commercial, societal, and governmental stakeholders, and emphasizing gender perspectives, equity, and humans rights.

The first activities of the SBHP after its launch in November 2023 will include the organization of educational and scientific events across the country, a systematic analysis of the global burden of brain disorders in Switzerland, the launch of an international Certificate of Advanced Studies on Brain Health, and the creation of international collaborations.

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## Appendix A

### Appendix A.1. The Burden of Seven Illustrative Groups of Brain Disorders

#### Dementia

- Prevalence: Briefly, there is a prevalence of 1% of the general population and of up to 30% of older adults [77,78]. In 2019, over 57 million people worldwide and 14.1 in Europe were affected by dementia [78]. A global increase to 153 million people in 2050 is expected [78].
- Burden: In 2019, the WHO ranked dementia as the seventh most common cause of death globally (<https://www.who.int/data> (accessed on 12 October 2023)). A 2016 global burden of disease (GBD) study ranked dementia as the third most disabling ND globally [22]. For Europe, the total costs for dementia were estimated to be EUR 105 billion in 2010 and EUR 392 billion in 2019 [16,79,80].
- Prevention: Up to 40% of dementia cases are potentially preventable because they are caused by 12 modifiable risk factors [43]. Intervention studies have shown the best effects so far through lowering of blood pressure [81].
- Recent advances in prevention: Multi-domain interventions delaying age-associated cognitive deterioration, blood biomarkers for population screening, and well-tolerated anti-amyloid drugs are effective in decreasing the incidence of cognitive impairment and dementia.

#### Stroke

- Prevalence: Briefly, there is a prevalence of 0.6% of the general population [82]. The lifetime risk of stroke is estimated to be 25% [83].
- Burden: In 2019, the WHO ranked stroke as the second most common cause of death and the third most disabling disorder globally (<https://www.who.int/data> (accessed on 12 October 2023)). In a 2016 GBD study, stroke was ranked as the most disabling ND globally [22]. For Europe, the total costs for stroke were estimated in 2010 to be EUR 64.1 billion [16].
- Prevention: Over 90% of the stroke burden can be attributed to nine modifiable risk factors [84,85]. Over 50% of strokes could potentially be prevented [57].
- Recent advances in prevention: These include new strategies for the detection of atrial fibrillation, new oral anticoagulants, new diabetes mellitus medication reducing the risk of stroke, and new strategies to treat dyslipidemia and sleep apnea.

#### Depression

- Prevalence: There is a prevalence of 20% of the general population during lifetime. The incidence of depression has increased in the past two decades [5].
- Burden: In 2019, the WHO ranked depression as the 12th most disabling disorder globally (<https://www.who.int/data/gho/data> (accessed on 12 October 2023)). A 2019 GBD study ranked depression at the 13th most disabling disorder globally [5]. For Europe, the total costs for mood disorders were estimated in 2010 to be EUR 113.4 billion [16].
- Prevention: Data from intervention studies are positive for populations with increased risk (e.g., children of depressed parents [86]).
- Recent advances in prevention: These include the promotion of physical health, physical activity, and emotion regulation strategies (involvement of social environment) [86].

#### Addiction

- Prevalence: There is a prevalence of 8% for alcohol and 2% for illicit drugs of the general population (lifetime prevalence) [87].
- Burden: In Europe, the total costs for addiction were estimated in 2010 to be EUR 65.5 billion [16].
- Prevention: This includes messaging, routine screening, and pathways for referral to (early) treatment in all (including pediatric) settings.
- Recent advances in prevention: These include campaigns for increased awareness, offers for safer use and harm reduction, poly- measures, and evidence-based technological interventions [88].

#### Headache

- Prevalence: There is a prevalence of 17% (migraine) to 30% (tension headache) of the general population. In 2019, over 1 billion people worldwide were affected by migraine [89].
- Burden: A 2016 GBD study ranked migraine as the second most disabling ND globally [22]. For Europe, the total costs for headache were estimated in 2010 to be EUR 43.5 billion [16].
- Prevention: Lifestyle factors including, stress, a lack of physical activity, unhealthy diet, bad posture, excessive use of digital technology, and many not seeking professional help increase the problem (“21st century headache”) [90].
- Recent advances in prevention: These include raised awareness and support, the development of non-pharmacological interventions, the prevention of chronic conditions through targeted and new treatments (i.e., CGRP-antagonist) [91].

**Epilepsy**

- Prevalence: There is a prevalence of 0.4% of the general population [92]. In 2016, nearly 50 million people worldwide had epilepsy [93]. The global lifetime risk of epilepsy is estimated to be 0.8% [92].
- Burden: The total costs of epilepsy worldwide were recently estimated to be USD 119 billion [94]. For Europe, the total costs for epilepsy were estimated in 2010 to be EUR 13.8 billion [16].
- Prevention: Up to 25% of epilepsies can be prevented [4]. Primary prevention can be promoted, reducing peripartal damage, stroke, neuro-infections, and brain trauma in traffic, sport, and professions [95].
- Recent advances in prevention: The association between vascular risk factors, focal epilepsy, and dementia offer novel targets for prevention [96].

**Sleep disorders**

- Prevalence: Insufficient sleep duration and sleep disorders (e.g., insomnia, excessive daytime sleepiness, restless legs syndrome, and sleep apnea) affect more than 30% of the general population [97,98].
- Burden: Insufficient (and/or fragmented) sleep and sleep disorders are linked with an increased risk of NDs (e.g., stroke, attention/cognitive problems, and dementia) and MDs (e.g., depression; emotional problems) [97,99–103]. For Europe, the total costs for sleep disorders were estimated in 2010 to be EUR 35.4 billion [16].
- Prevention: Sleep hygiene can prevent (some) sleep disorders. This includes setting a regular sleep schedule, creating a relaxing bedtime routine, turning off electronic devices, avoiding/limiting sleep-disturbing factors (caffeine, alcohol, nicotine, and stimulants), and, during the day, exercising and limiting naps.
- Recent advances in prevention: Several (measurable) dimensions of sleep including depth, duration, continuity, and timing have been linked to health outcomes and are becoming the target of interventions to prevent multiple disorders (including NDs and MDs) and wellbeing [102].

## Appendix A.2. Five Healthy Behaviors to Enhance Brain Resilience/Promote Brain Health

<p><b>Healthy diet</b></p> <ul style="list-style-type: none"> <li>• A healthy diet is essential for individuals at all ages. It includes at least five portions of fruits and vegetables per day, legumes, nuts and whole grains, less than 10% of the total energy intake coming from free sugars, less than 30% of the total energy intake coming from fats, and less than 5 g of salt per day [104–107]. In children, the intake of free sugars should be reduced and minimized with a desirable goal of &lt;5% of the energy intake in children and adolescents aged 2 to 18 years [107,108].</li> <li>• Adequate nutrition, breastfeeding and the treatment of deficiencies during pregnancy and early life are essential for optimal brain development. Suboptimal diet influences the cognitive development of preschool children and increases the risk of NDs (e.g., stroke) and MDs (e.g., depression) [82,100,109,110].</li> </ul>
<p><b>Good/sufficient sleep</b></p> <ul style="list-style-type: none"> <li>• At least 7–9 h of good (uninterrupted/restful) sleep per day is recommended in adults. Up to 20–40% of the general population sleeps, however, &lt;7 h/day [97,98,102].</li> <li>• Minimal recommendations in children range from 8 to 12 h depending on age [99].</li> <li>• Insufficient sleep duration and sleep disorders have adverse health effects including an increased risk of NDs and MDs (in addition to obesity, diabetes, cancer, and cardiovascular disorders) [97,99–103].</li> </ul>
<p><b>Physical activity/exercise/sport</b></p> <ul style="list-style-type: none"> <li>• Regular physical activity is essential for people of all ages.</li> <li>• At least 150–300 min of moderate-intensity aerobic physical activity, at least 75–150 min of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity activity throughout the week for substantial health benefits among adults, and an average of 60 min of moderate aerobic physical activity per day for children and adolescents is recommended [42,111,112]. The gain is even higher when being active for at least 300 min (5 h) per week [42]. The WHO also emphasizes the importance of muscle strength for optimal health [112].</li> <li>• Greater amounts of physical activity lead to improvements in cognition. Physical activity/exercise and high levels of fitness reduce the risk of dementia and mental disorders including depression [43,100,113].</li> <li>• Low-level physical activity increases the risk of NDs such as stroke and dementia [82,103]. Lower levels of physical activity (and higher levels of screen time) are associated with poorer mental health in children [114,115].</li> </ul>
<p><b>Cognitive/mental activity</b></p> <ul style="list-style-type: none"> <li>• Higher education reduces the risk of dementia [113]. Even in later life, educational, cognitive and leisure activities can promote the cognitive reserve and reduce age-associated cognitive deterioration [116,117].</li> <li>• Primary school education levels (or lower) are associated with an increased risk of dementia [24].</li> </ul>
<p><b>Social activity/interactions</b></p> <ul style="list-style-type: none"> <li>• Lively social interactions (defined by marital status, exchanging support with family members, contact with friends, and participation in community groups) decrease the risk of dementia [43]. Social activities and support have a favorable effect on mental health and, e.g., the risk of depression [100,118].</li> <li>• Social isolation in later life is associated with an independent increased risk of dementia [119], and chronic loneliness is a significant predictor of cognitive decline [120].</li> </ul>

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