



National Brain Health Programme

A HUMANLY SUSTAINABLE SOCIETY THAT SUPPORTS BRAIN HEALTH

Working paper

Aejmelaesus Riitta, Hartikainen Kaisa, Kaila Kai, Keltto Tarja,
Korkeila Jyrki, Larivaara Meri, Lisko Inna, Lähteenkorva Satu,
Ojanen Ville, Pyykkö Mika, Ristikari Tiina, Sajaniemi Nina, Unkila Kaisa

Table of Contents

Abstract	4
Introduction	6
Interfaces with other recommendations and programmes that promote brain health	8
The National Brain Health Programme preparation process	10
Experts groups	12
Children and young people (families)	12
Working-age population	12
The elderly	12
Summary working group	12
What is brain health?	13
Programme framework	14
Impact goal: A humanly sustainable community that supports brain health	14
Outcome objective: The understanding of brain health and brain disease and the appreciation of brain wellbeing have been strengthened	14
Outcome objective: Brain ergonomics have been applied to operating environments	15
Outcome objective: Everyone has the opportunity for refreshing and restorative sleep	15
Outcome objective: Our sense of belonging has been strengthened – we are all withizens, fellow citizens, together	15
Children and young people	17
Impact goal: Growth environments promote stress management	17
Outcome objective: Understanding of the prerequisites for brain health associated with growth and development has increased and it guides the development of growth environments	18
Outcome objective: Operating environments take brain ergonomics and age-appropriate level of development into account	19
Outcome objective: The adequate quality and amount of sleep according to the level of development is ensured	20
Outcome objective: Experiences of belonging and safety have improved	20
Working-age population	22
Impact goal: Work and operating environments enhance the health and well-being of the brain	23
Outcome objective: Brain health knowledge directs the practical activities of both individuals and communities as well as political decision-making	23
Outcome objective: Work and operating environments take brain ergonomics into account	23
Outcome objective: The working-age population gets enough refreshing sleep	24
Outcome objective: Fellow citizenship is strengthened—The opportunities and abilities related to inclusion and the experience of inclusion and togetherness have increased	25
The elderly	28
Impact goal: A society that appreciates the elderly, makes autonomy possible and takes care of safety	28
Outcome objective: Brain health information is in optimal use	29
Outcome objective: The environments of the elderly take brain ergonomics into account	30
Outcome objective: The elderly get enough refreshing and restorative sleep	30
Outcome objective: Experiences of inclusion and meaningfulness have increased	31
Implementation plan	34
Sources	35
Reports, programmes and surveys that have interfaces with the National Brain Health Programme	39

Abstract

The Finnish Brain Association started preparing the National Brain Health Programme in October 2021. Three factors were emphasised in drawing up the programme: an impact-driven approach, meaning the definition of measurable objectives, the perspective of protective factors and making use of co-creation in defining the objectives. Current programmes and strategies related to brain health were surveyed in order to avoid overlap. In addition, various information retrievals were carried out and a research-based report “Mikä edistää aivoterveyttä?” (What promotes brain health?) was commissioned from E2 Research.

Highlighting protective factors, together with a preventive and impact-based approach, makes the programme globally unique in the area of brain health.

Lead by the Finnish Brain Association and its coordination partners, a total of 50 experts representing a variety of scientific disciplines gathered to work on the programme during spring and early autumn 2022. Brain health was examined from the perspective of protective factors within three age-group-specific expert groups (children and young people, working-age population and the elderly). Each group convened a total of three times. First, each expert group defined what brain health is and then what the long-term social impact goal for the programme is. Finally, the groups defined and prioritised brain-related outcome objectives that enable reaching the social impact goal. After the age-group-specific work, some of the experts formed a fourth, summarising working group.

The summarising working group and two seminars open to all the experts were used to provide a basis for the long-term social impact goal of A humanly sustainable community that supports brain health and the following outcome objectives to enable its realisation:

- The understanding of brain health and brain disease and the appreciation of brain wellbeing have been strengthened
- Brain ergonomics have been applied to operating environments
- Everyone has the opportunity for refreshing and restorative sleep
- Our sense of belonging has been strengthened – we are all withizens, fellow citizens, together

In addition to these four outcome objectives, special attention is paid to sufficient physical activity, healthy nutrition and abstinence from substance use, all of which are also cornerstones of brain health.

All of these objectives are approached from the perspective and operating environment of each specific age group. In autumn 2022, three age-group-specific expert groups further specified prerequisites for the defined goals to facilitate practical measures. In this way, the prerequisites and emphasis of the objectives can be at least partially tailored to each of the age groups.

In late 2022, a working group comprised of representatives of the Finnish Brain Association and some new coordinating partners, have begun drawing up and carrying out an implementation plan. The implementation period of the programme is 2023–2029.

Introduction

Few things are more closely linked to our overall health and well-being than our brain health. Brain health encompasses the perspectives of neural development, brain plasticity, brain function and recovery throughout life. The promotion of brain health enhances an individual's ability to cognitively, emotionally and functionally increase their control over their life while promoting general health and well-being. Taking care of brain health is an investment in the future with far-reaching, positive consequences throughout the whole society. The National Brain Health Programme focuses heavily on the health of the brain as an organ system and its optimal functioning. Securing the functional integrity and structure of the brain also promotes general health, mental health and well-being.

The Finnish Brain Association Board of Directors decided on initiating the preparation of the National Brain Health Programme in September 2021. Prior to this, an association representative had discussed the need for such a programme and its content with the representatives of various different organisations. The idea behind the Board's decision was that the role of the Finnish Brain Association would be to coordinate the preparation of the national programme with a co-creation model. Other key aspects of the preparation of the programme included focusing on the programme's impact and factors that protect brain health.

An additional goal was to avoid overlaps with existing recommendations and strategies that promote brain health and to produce as concrete an implementation plan as possible to supplement these recommendations and strategies. In the preparation phase, relevant factors related to brain health that have not received enough attention according to experts were prioritised. Where the scope and focus of the programme has been limited, statements and recommendations prepared by other parties and actions that have already been taken are referred to.

The purpose was to broaden the current focus on disorders and risk factors to resource and protective factors: What factors need to be strengthened or developed in order to make our brains as healthy and well as possible. The importance of these factors for the promotion of brain health and well-being is based on research, practical experience and views of the expert group, as well as general understanding of the functioning, health and well-being of the brain and mind. The National Brain Health Programme studies brain health primarily from the proactive perspective of protective factors. To a certain extent, the theme is reviewed from the more traditional perspective of preventive activities, i.e. the perspective of risk factors related to brain health (Figure 1).



The brain is in constant interaction with the body, the environment and a more extensive physical and social context. Consequently, the functioning and structure of the brain can be affected not only through biological factors and physiological methods, but also with various psychological and social means related to the mind. The objectives and goals of this programme take these different methods of protecting brain health into consideration.

The programme views common objectives and goals with the needs and perspectives of three age groups in mind: children and young people, the working-age population and the elderly. The basis of the brain health for the elderly is established in working age and, similarly, the basis of the working-age population's brain health is laid down in childhood and adolescence. Consequently, the promotion of the brain health of children and young people is the most fruitful throughout an individual's life and has far-reaching, extensive impact on society. Various factors that promote brain health are the same regardless of the age group, although the methods and environments in which brain health is most effectively promoted can be significantly different. Different age groups also have some special characteristics related to brain health.

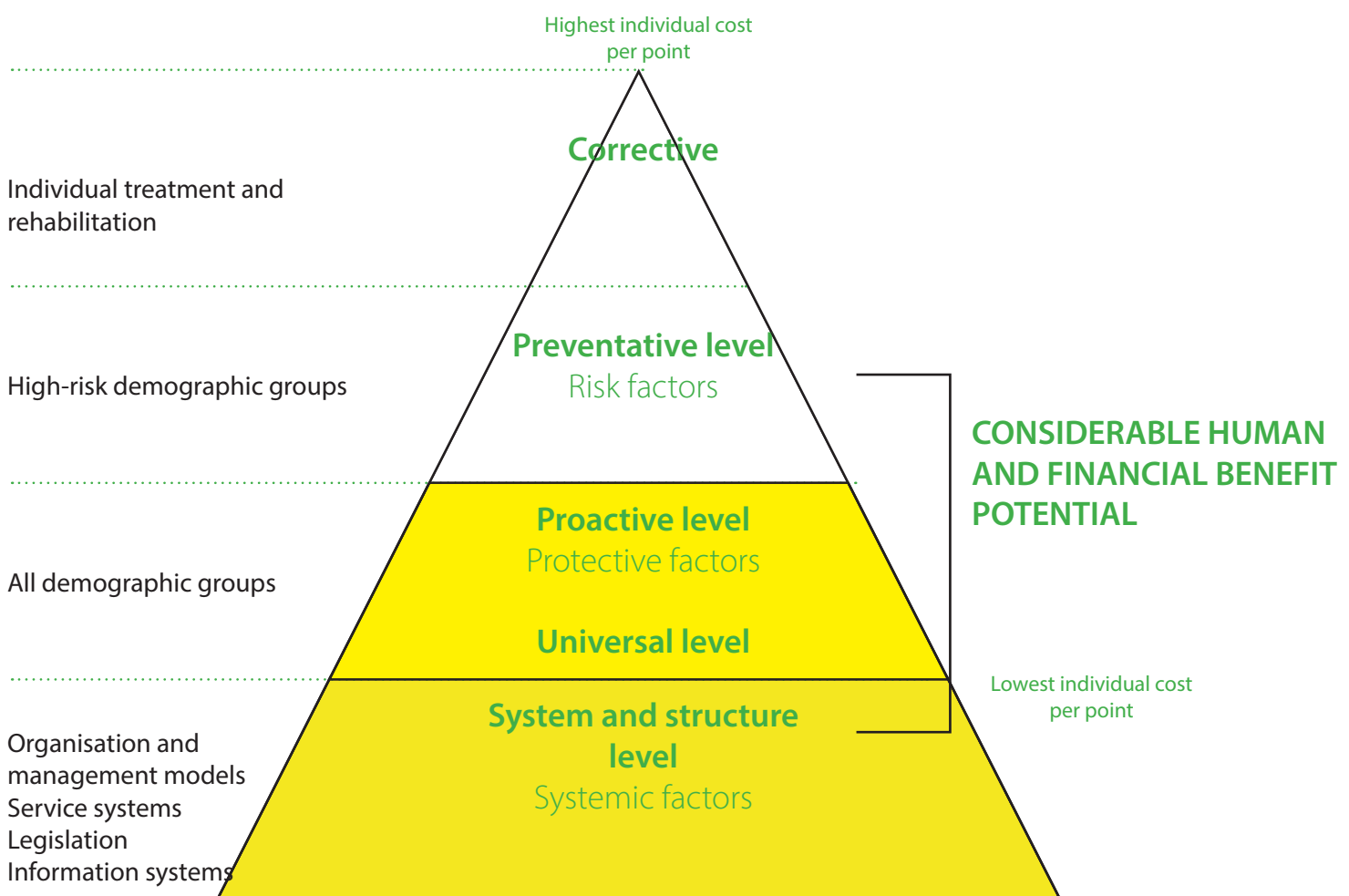


Figure 1. Proactive level, on which this brain health programme is focused on, is an earlier level that focuses on a more extensive segment of the population than the conventional preventative level. This level emphasises the importance of factors that protect brain health.

Interfaces with other recommendations and programmes that promote brain health

The National Brain Health Programme has interfaces with various currently existing recommendations and strategies that promote brain health. These recommendations include, for example, nutrition and physical activity recommendations, Current Care Guidelines related to brain diseases (including cerebral infarction and transient ischaemic attack [2020], memory disorders [2021], depression [2022], schizophrenia [2022] and brain injury [2021]) as well

as national and international recommendations related to the prevention of memory disorders and mild cognitive impairment. A table of these different recommendations is presented below. Among the key actions in the treatment of brain diseases, risk of brain injuries and disruption of brain function can be reduced in both brain structure and function integrity to be safeguarded.

Preventative method	Functional disorder, brain disease or injury
Proactive and preventative activity	Brain disease or injury
Weight control	Stroke, mild cognitive impairment, memory disorders
Balanced diet with a high proportion of unsaturated fats of all fats and vegetables, fruit and berries. Avoidance of excessive sugar and salt.	Stroke, mild cognitive impairment, memory disorders, depression
Avoidance of toxic substances (alcohol, drugs, including cannabis)	convulsions, stroke, mild cognitive impairment, memory disorders, brain injury, depression, schizophrenia
Managing gum health	Stroke, mild cognitive impairment, memory disorders
Non-smoking lifestyle	Stroke, mild cognitive impairment, memory disorders, depression
Physical activity	Stroke, mild cognitive impairment, memory disorders, depression
Intellectual activity/brain exercise	Mild cognitive impairment, memory disorders
Social activity	Memory disorders, depression
Avoidance of excessive mental stress/work stress	Stroke, mild cognitive impairment, exhaustion, depression
Traffic and physical activity safety	brain injury, mild cognitive impairment, epilepsy
Prevention of hypertension and early, effective treatment with lifestyle changes and/or medication	Stroke, mild cognitive impairment, memory disorders
Prevention of diabetes and early, effective treatment with lifestyle changes and/or medication	Stroke, mild cognitive impairment
Prevention of dyslipidemia and early, effective treatment with lifestyle changes and/or medication	Stroke, mild cognitive impairment, memory disorders

Early diagnosis and treatment of atrial fibrillation	Stroke, mild cognitive impairment, memory disorders
Early diagnosis and effective treatment of sleep apnoea	Stroke, mild cognitive impairment, brain injury, depression
As good hearing as possible with a hearing aid	Mild cognitive impairment, memory disorders, depression

Table 1. The left pane indicates the preventative method and the right pane the brain disease, functional disorder or brain injury the risk of which is particularly associated with the factor. The table is not supposed to be exhaustive but only indicative. Memory disorders also include such forms of dementia where the initial symptoms or challenges are not related to memory.

Other key interfaces with the National Brain Health Programme are presented in this chapter. In 2020, the consensus statement Brain and Mind that brings together various key factors related to brain health and mental well-being was published. The Ministry of Social Affairs and Health's National Programme on Ageing 2030: For an Age-Competent Finland, published in 2020, raises awareness of challenges related to ageing and methods for improving the well-being of the elderly. The National Mental Health Strategy (Vorma et al., 2020) aims to take mental health into account in society and its various industries and levels. The Promotion of wellbeing, health and safety 2030 Government resolution sets out the measures for reducing inequalities in the health and well-being of people in Finland by 2030. Its implementation plan is focused on four priority areas: 1) Opportunity for all to get involved, 2) Good everyday environments, 3) Measures and services promoting well-being and health and 4) Decision-making generates effectiveness. The Right to Learn development programme of the Ministry of Education and Culture (2020–2023) focuses on promoting support for learning, support for children and inclusion. The programme emphasises inclusion and the child's right to be part of their immediate community. The preparation of the National Child Strategy was completed in 2/2021. In its implementation plan for this government

term, it emphasises the role of early childhood education and schools as communities. Improving children's relationships with their loved ones and peers is a shared strategic policy (National Child Strategy Implementation Plan). The significance of physical activity on brain health has been researched extensively and the various programmes aimed at increasing the physical activity of different age groups include such programmes coordinated by the Ministry of Education and Culture as Active early childhood education, Active schools and Active working life. The UKK institute has prepared physical activity recommendations for preschoolers, schoolchildren, adults (18–64) and the elderly (65+). The Finnish Model for Leisure Activities project coordinated by the Ministry of Education and Culture aims to provide as many children and young people as possible with a pleasant, free hobby during their school day.

Improving the level of brain health awareness and understanding became one of the cross-cutting outcome objective of the programme, on which other similar objectives are heavily based. This objective is firmly based on existing recommendations and establishing their key messages. In addition, the aim is to expand the mindset from brain health to brain well-being and to promote factors that protect the well-being of the brain.

The National Brain Health Programme preparation process

The Finnish Brain Association Executive Director Mika Pyykkö and experts Maija Lammio (1 Oct 2021–20 Mar 2022) and Tarja Keltto (1 Mar 2022–) were responsible for the coordination of the programme's preparation. The Finnish Brain Association coordinated the preparation process in cooperation with its age group-specific coordination partners using a co-creation model and the multidisciplinary expertise of various experts. The preparation of the programme focused on highlighting the end result with an impact-based and adequately concrete implementation plan.

The framework of the preparation phase included:

- implementation of the complete programme in 2023–2029
- proactive approach and emphasis on protective factors
- impact-based approach
 - measurable outcome objectives and impact goals
 - generating measurable human and social added value
 - modelling social benefits
- complementing existing recommendations and measures
 - the completed programme is part of a larger framework
 - the actions outlined in the government resolution "Promotion of wellbeing, health and safety 2030 and non-communicable diseases (NCDs)", for example, are taken into account
- assigning strategic and operational roles to various operators
 - wellbeing services counties are taken into consideration in the implementation
- combination of the success of the use of public expenditure and proactive and preventative operations
- utilisation of outcomes contracting, where applicable

The preparation phase was officially launched in early October 2021. First, an as comprehensive survey as possible of experts who could be invited to take part in the preparation of the programme was carried out and workshops for neurological and NCD organisation representatives where the framework of the preparation work was planned were organised.



In addition, two workshops for the preparation of the brain health programme were carried out to allow the experts to consider the similarities shared by the prevention of various non-communicable diseases as extensively as possible. The purpose of this was to complement the actual programme preparation's emphasis on protective factors.

During the first months of the preparation phase, the representatives of the Finnish Brain Association studied the results and materials of studies produced under the title of brain health as extensively as possible and contacted dozens of experts from different scientific fields. Based on this, it was decided that the preparation should be continued in three different expert groups in spring 2022 to focus on the brain health of children and young people (families), the working-age population and the elderly. To support their work, the Finnish Brain Association ordered a survey based on scientific data from E2 Tutkimus, which was a literary survey of the contexts in which

brain health is studied and what is referred to with the term brain health. The emphasis of this survey was on behavioural and social science studies.

From 10 to 15 brain health and other experts representing different scientific fields were invited to each of the three expert groups. It was also considered important to find a coordination partner for the Finnish Brain Association to coordinate the work of each expert group. Research Professor Tiina Ristikari from Itla Children’s Foundation was the coordination partner overseeing the preparation of the programme concerning children and young people. With regard to the working-age population, the partners were Head of the Behavioural Neurology Research Unit of Tampere University Hospital Kaisa Hartikainen, Project Manager Mirva Kolonen and Project Coordinator Kirsi Toljamo from the Sustainable Brain Health project. In addition to the aforementioned project, the coordination partners for the elderly included Research Professor Inna Lisko from the Gerontology Research Centre GEREC.

Each expert group convened three times for two-hour workshops in spring 2022. The workshop process for each of the expert groups was the same:

Workshop 1

definition of brain health

- what is brain health and what factors affect it

Workshop 2

definition of social impact goals

- social benefits generated by the end of the 2020s as a result of improved brain health

Workshop 3

definition of outcome objectives

- supporting changes or currently existing positive factors that are a prerequisite for accomplishing the impact goal
- the aim was to establish outcome objectives that are closely linked to brain health and brain well-being

In addition to a written summary, graphic recorder Salla Lehtipuu created a visual illustration of each workshop. In late spring and early autumn 2022, an expert group led by Kaisa Hartikainen with representatives of all three age group expert group that aimed to harmonise the results of the expert groups was active.

The goals and objectives of the National Brain Health Programme were established in a seminar on 13 June 2022 and complemented in another seminar on 6 September 2022. In addition, the goals and objectives were specified and the view on the prerequisites for accomplishing them was established in August

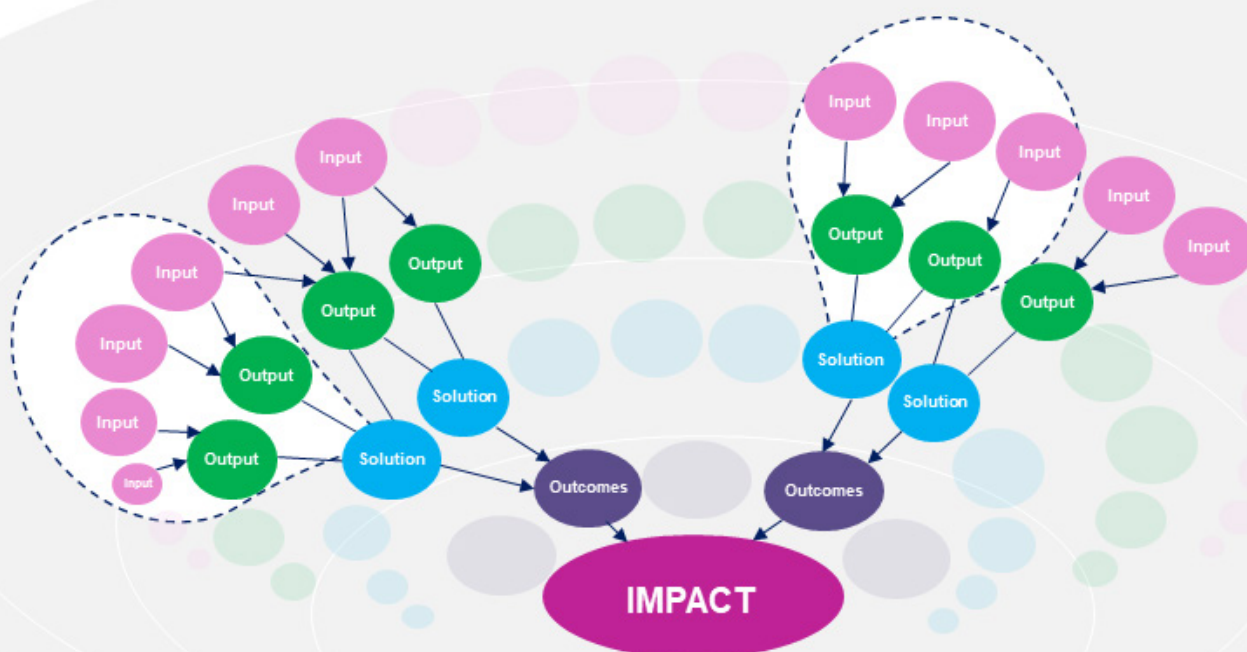


Figure 2. The programme’s basic idea was an impact-based approach with measurable outcome objectives and impact goals. The impact ecosystem is illustrated here. Each age group has a specific outcome chain.

Experts groups

Children and young people (families)

Coordination partner: Itla Children's Foundation and Research Professor Tiina Ristikari.

Experts:

Emmi Jäkkö, Executive Director (Finnish Reading Center), Kai Kaila, Professor (University of Helsinki), Silja Kosola, Docent (University of Helsinki), Taina Laajasalo, Chief Specialist (Finnish Institute for Health and Welfare), Päivi Lindberg, Chief Specialist (Finnish Institute for Health and Welfare), Kaisu Muuronen, Senior Advisor (Central Union for Child Welfare), Marie Rautava, Programme Director (Mannerheim League for Child Welfare), Leena Repokari, Head of Child Psychiatry (Helsinki University Hospital), Aino Saarinen, University Lecturer (University of Helsinki) and Nina Sajaniemi, Professor (University of Eastern Finland). In addition to the people present in the workshop, written statements were provided by: Linnea Karlsson, Associate Professor (University of Turku) and Mirjam Kalland, Professor (University of Helsinki).

Meeting dates and location:

4 March, 25 March and 11 April 2022 Helsinki

Working-age population

Coordination partners: Head of the Behavioural Neurology Research Unit of the Sustainable Brain Health project Kaisa Hartikainen (Pirkanmaa Hospital District), Project Manager Mirva Kolonen (Tampere University) and Project Coordinator Kirsi Toljamo (Tampere University).

Experts:

Tino Karolaakso, Occupational Psychologist, Doctoral Researcher (Tampere University), Kirsi Karvala, Senior Medical Consultant (Varma Mutual Pension Insurance Company), Päivikki Koponen, Chief Specialist (Finnish Institute for Health and Welfare), Satu Lähteenkorva, Psychologist (Psykologipalvelu Core), Satu Mustonen, Senior Advisor (Organisation for Respiratory Health in Finland), Ida Nummelin, Senior Advisor, Social and Health Policy (Finnish Confederation of Professionals), Ville Ojanen, Psychologist (Academy of Brain), Tiina Parviainen, Associate Professor (University of Jyväskylä), Anne Ranta, Work Environment Officer (Trade Union for the Public and Welfare Sectors), Matti Rautalahti, Secretary General (Duodecim), Auli Rytivaara, Chief Medical Officer (Confederation of Finnish Industries), Tiina Saanijoki, Research Leader (University of Turku) and Riitta Sauni, Professor (Tampere University).

Meeting dates and location:

22 March, 8 April and 29 April 2022 Helsinki

The elderly

Coordination partner: Research Professor Inna Lisko (GEREC, University of Jyväskylä).

Experts:

Riitta Aejmelaeus, Budget Counsellor (Ministry of Finance), Virpi Annaniemi, Development Manager (Miina Sillanpää Foundation), Kaisa Hartikainen, Neurologist, Associate Professor (Pirkanmaa Hospital District), Sirkkaliisa Heimonen, Sector Manager (Age Institute), Mirva Kolonen, Project Manager (Tampere University), Jyrki Korkeila, Professor (University of Turku), Pia Pulkkinen, Specialist (Finnish Institute for Health and Welfare), Laura Rautiainen, Coordinator (Finnish Association for the Welfare of Older People), Timo Strandberg, Professor (University of Helsinki), Teppo Särkämö, Associate Professor (University of Helsinki), Minna Teiska, Development Manager (Alzheimer Society of Finland) and Kirsi Toljamo, Project Coordinator (Tampere University).

Meeting dates and location:

29 March, 9 May and 24 May 2022 Helsinki

Literary expert support concerning the outcome objective related to sleep in the preparation of the programme was provided by Timo Partinen, Research Professor (Finnish Institute for Health and Welfare) and, with regard to the FINGER study, Jenni Kulmala, Senior Researcher (Finnish Institute for Health and Welfare).

Summary working group

Based on the work performed by the three age group-specific working groups, a fourth expert group with 2–3 representatives of each working group and two experts not included in the expert groups active in the spring was assembled. This working group was led by Neurologist, Associate Professor Kaisa Hartikainen.

Experts:

Riitta Aejmelaeus, Budget Counsellor (Ministry of Finance), Kai Kaila, Professor (University of Helsinki), Jyrki Korkeila, Professor (University of Turku), Meri Larivaara, Director, Senior Advisor (MIELI Mental Health Finland), Inna Lisko, Research Professor (University of Jyväskylä), Satu Lähteenkorva, Psychologist (Psykologipalvelu Core), Tiina Ristikari, Research Professor (Itla Children's Foundation), Nina Sajaniemi, Professor (University of Eastern Finland) and Kaisa Unkila, Head of Services (Neurocenter Finland).

Maija Lammio or Tarja Keltto and Mika Pyykkö participated in the work of all of the aforementioned expert groups. In addition, QSA Oy representatives Liisa Björklund and/or Petri Hilli, who are primarily responsible for the modelling of the programme's social benefit and, consequently, the definition of the indicators related to the accomplishment of goals and objectives, participated in various meetings of the expert groups. A wide range of experts from different industries also participated in the development of the programme via individual remote meetings and two seminars held in Helsinki on 13 June and 6 September 2022.

What is brain health?

The brain is the hub of psychological functions and the control centre of the nervous system that regulates the physiology of the entire body. The brain is responsible for behaviour, emotions, information processing and their control. These control functions are called executive functions (Diamond, 2013). Executive functions reflect brain health and the well-being of the brain (Erkkilä et al., 2018; K. Hartikainen, Pihlaja, & Kolonen, 2021; Liimatainen et al., 2016) and, on the other hand, they also play a key role in maintaining brain health with regard to healthy lifestyle choices, for instance. The brain has a key impact on the body's metabolic (Roh et al., 2016), hormonal (Clasadonte & Prevot, 2017) and immunological functions (Poller et al., 2022). Brain health defines overall health significantly since the brain is responsible for both our actions and experiences. Consequently, the promotion of brain health is a key part of improving general health, well-being and quality of life.

Brain health does not have a universally recognised definition and the term is used differently in different fields of science. The Finnish Brain Association commissioned E2 Tutkimus to carry out the Mikä edistää aivoterveyttä? (2022) survey. According to the two concept analyses made in the survey, brain health was defined as follows: "Brain health is the ability to adapt optimally to the internal and external environment of an individual through cognitive and emotional responses over entire lifespans. Brain health can be measured objectively—on the other hand, brain health is also an individual's subjective experience of

their own brain health. Brain health is affected and defined by the individual's living environment and biological, psychological and social factors."

The definition of brain health is challenging. It depends on the party making the definition and it has changed over time. The World Health Organization WHO defines brain health as the state of brain functioning across cognitive, sensory, social-emotional, behavioural and motor domains, allowing a person to realize their full potential over the life course, irrespective of the presence or absence of disorders. The aspect of brain health definitions made from the perspective of neurology is strongly linked to brain diseases and their risk, but the positive continuum of brain health to the optimal well-being of the brain has been neglected. On the other hand, the definitions typically overlook the individual's experience of their mental well-being and even happiness.

The expert groups decided to establish the preparation of the National Brain Health Programme on the notion that brain health is a dynamic state in which the integrity of the brain is maintained, behaviour is purposeful and the individual's functional capacity and experience of mental well-being is positive. According to the definition of WHO, the expert groups considered that the promotion of brain health improves the individual's emotional, cognitive and social functioning.



Programme framework

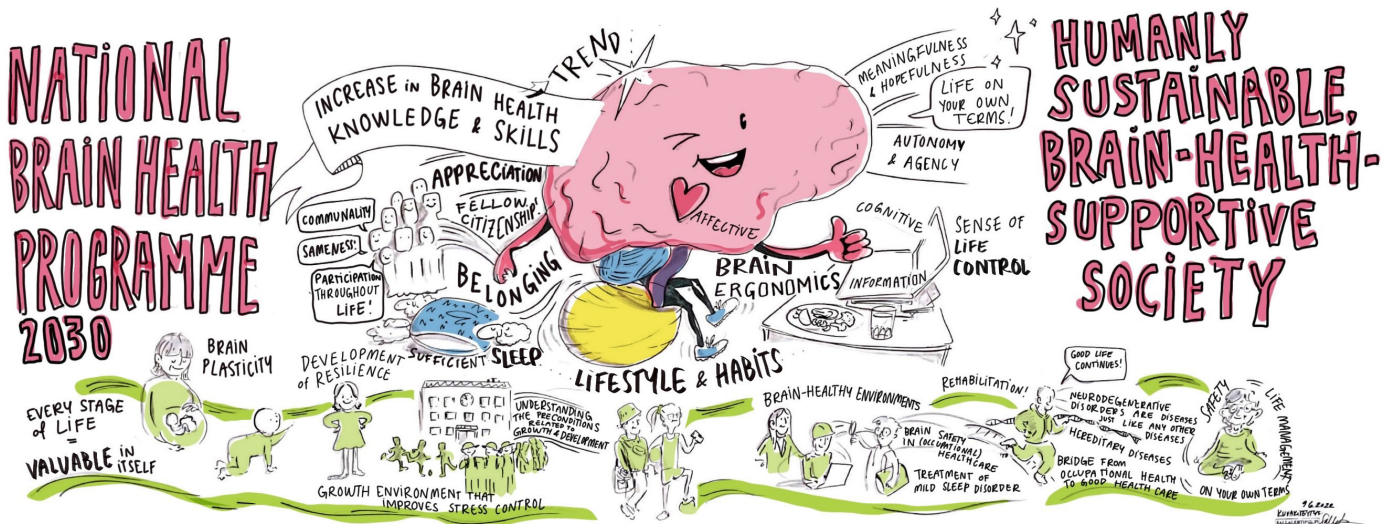


Figure 3. The programme framework illustrated by Graphic Recorder Salla Lehtipuu.

Impact goal: A humanly sustainable community that supports brain health

The primary impact goal of the whole programme, which was also common to all age groups, was a humanly sustainable society. It is humanly sustainable to develop society in a way that increases everyone’s opportunities for experiencing emotions that are necessary for human life and human nature, such as love, care, fairness, significance, trust, safety, inclusion, capability and agency. These opportunities are created in fruitful, interdependent interaction between the brain, the mind, the community and its structures.

A humanly sustainable society takes into account, supports and protects humanity, the brain and psychological functions. This, in turn, supports the happiness, significance and sense of belonging of the members of society and that they feel included and are active.

Outcome objectives common to all age groups:

- **Understanding of brain health and diseases as well as the appreciation of brain well-being has increased**
- **Operating environments take brain ergonomics into account**
- **Everyone has the opportunity for refreshing and restorative sleep**
- **The sense of belonging has increased – all citizens are fellow citizens**

Outcome objective: The understanding of brain health and brain disease and the appreciation of brain wellbeing have been strengthened

Awareness of brain health is increasing rapidly, but it does not encompass the entire population. Many people find it hard to form an overall picture of this information and apply it in practice. There are also shortcomings in the brain health awareness of many people, including social, health care and pedagogy professionals and how they apply the information to promote brain health.

In order for brain ergonomics, the tools and practices that support the comprehensive well-being of the brain, to be taken into account in the living environments of people and in social and health care services, awareness of the brain’s functions needs to be increased. Information about the normal and disturbed functions of the brain is needed by common people, the professionals of different industries, occupational health experts and employers. In addition to the basic information related to the functioning of the brain, better understanding of how the information can be applied in everyday operations is needed. Furthermore, skills and opportunities for acting according to this information are required.

In order to change behaviour, information and freedom of choice is not enough. Instead, attitudes and values must be reviewed. It is particularly difficult to recognise the significance of human capital and the role of promoting brain health. Increasing brain health

awareness makes it possible to identify factors that stress the brain and to apply protective, strengthening and preventative measures in practice throughout an individual's lifespan.

Outcome objective: Brain ergonomics have been applied to operating environments

In order to avoid unnecessary stress caused by modern life, work and studying, it is important to promote the brain ergonomics of various environments. Brain ergonomics refers to taking into account normal brain functions and limitations in a way that prevents unnecessary, harmful stress to the brain. Affective ergonomics takes into account the regular emotional functions of the brain, cognitive ergonomics is about the characteristics and limitations of the brain's information processing capacity while information ergonomics aims to prevent unnecessary information overload. Brain ergonomics consists of all these areas.

The modern information society sets various challenges for the brain in learning, working and free time environments and various services, regardless of the individual's age. There are special parameters for different health situations and ages concerning the well-being and functions of the brain that need to be taken into account to avoid unnecessary brain stress.

In addition to the working-age population, young people, also including children, are at risk of burnout. Not only job burnout is on the rise, but so is school burnout. With regard to the elderly, it is also important to avoid negative or unnecessary brain stress to promote the quality of life and well-being. On the other hand, it is also important to safeguard the services that take into account the well-being of the brain as well as challenges related to ageing and brain diseases that are increasingly common with age in a way that allows for inclusion and agency in different life stages regardless of the challenges related to brain functions. Age discrimination reduces inclusion and agency and eliminating this supports brain health through various mechanisms. More attention must be paid to the cognitive accessibility of services so that they are easy to use, the information provided is comprehensible and people with cognitive challenges can access them. Cognitive accessibility is emphasised as digital services become more common and it is also a key aspect of equality.

Outcome objective: Everyone has the opportunity for refreshing and restorative sleep

Sleep has a vital role in the well-being and health of the brain. Sleep has various functions related to alertness, brain cleansing functions (Helakari et al., 2022), information processing, emotions, stress management, recovery as well as hormonal and immunological functions (Partonen, 2022).

Insufficient sleep increases the risk of accidents and various diseases. In addition, insufficient sleep weakens the mood, pain threshold and information processing functions, especially functions related to memory and executive functions. Insufficient sleep may be a result of various reasons. The amount of sleep may be too low or its quality is poor. In some cases, not enough time is allocated for sleeping. Sometimes, social or physical factors related to the environment do not support sufficient, undisturbed sleep. The condition may be linked to insomnia or other sleep disorders.

Insufficient sleep affects the development of the brain, learning, functional capacity and the experience of well-being negatively. Mental health and behavioural disorders as well as musculoskeletal system disorders are the most significant groups of diseases that cause incapacity for work. Lack of sleep is closely associated with both groups through negative mindsets and emotions, sensation of pain, poor commitment to treatment methods and poor stress management.

Conversely, sufficient, restorative sleep supports information processing functions, healthy mood, autonomic nervous system balance and recovery from both physical and mental stress. Due to the important restorative effect of sleep, it is the basis of the adults' physical recommendations outlined by the UKK Institute, on which everything else is built.

Outcome objective: Our sense of belonging has been strengthened – we are all withizens, fellow citizens, together

Strong social relationships support brain health and even reduce morbidity (Holt-Lunstad et al., 2010). The brain reacts strongly to social rejection, which is associated with an overload of information processing functions, negative emotions and a stress response and may reduce the individual's well-being and expose them to various diseases. Exclusion and loneliness can also increase the risk of memory disorders, for

instance (Shen et al., 2022). The National Brain Health Programme highlights the sense of belonging and inclusion as a cross-cutting outcome objective for all age groups. This objective is embedded in the concept of fellow citizenship.

It refers to the intertwined relationship between the most important basic psychological human need, the sense of belonging, and the sense of importance (Deci & Ryan, 2009). Fellow citizenship is about sharing an important and authentic thing, existence or an activity with someone else while experiencing inclusion and restoring and strengthening the balance of the individual (Ryan & Deci, 2017). A fellow citizen is someone with whom it is possible to strengthen the sense of importance and inclusion in life.

Through evolution, the brain has established robust emotional networks that are designed to protect the survival of the individual and the species. Fear is an important emotion that helps us protect ourselves from danger and it is triggered when the brain senses a threat to our well-being or survival. The threat generates automatic, unconscious fear and stress responses, which is purposeful when the fear helps us avoid the danger and the stress mobilises the required physical and mental resources to overcome the danger (Mobbs et al., 2015). The brain's information processing resources are allocated for assessing and minimising the threat. The threat may take over the brain's alertness and executive function resources from other

functions (K. M. Hartikainen et al., 2000, 2007, 2010, 2012), which may reduce the individual's ability to carry out their duties at work or the ability to make choices that are good for their health.

Social exclusion causes emotional pain, which stimulates the same areas of the brain as physical pain (Eisenberger et al., 2003). Consequently, social rejection causes fear, and the threat of it activates the brain's emotional and stress networks in the same way as the threat of physical injury. The factors that support the experience of inclusion and belonging provide psychological safety and protect health with many various mechanisms (Martela & Ryan, 2016). For these reasons, it is important to provide people with psychologically safe environments where they can feel that they are respected, important members of a community. This reduces harmful stress and lets the brain's information processing functions to focus on purposeful activities or, for example, creative processes, supporting the individual's active agency.

The following chapters present the National Brain Health Programme's age group-specific needs and the targeted outcome objectives and impact goals for each age group and their prerequisites. The same outcome chain descriptions can be found as tables on pages 21, 27 and 33.



Children and young people



Need: Taking care of brain health safeguards peaceful growth and creates prerequisites for lifelong well-being

The brains of children and young people go through a major development and formation process and not all functions of the brain have yet fully developed to the level they are in in adulthood. For example, executive functions are the last functions to fully mature approximately at the age of 20. Because of this, it is important to let the brain grow peacefully in childhood and adolescence and to support the normal, age-appropriate development of the brain and the individual and, in particular, the development of stress management mechanisms. A firm basis for lifelong brain health and well-being is established in childhood and adolescence. Conversely, various harmful factors may be reflected in the incidence of diseases decades later. It is also important to pay attention to developmental challenges, reduce the stigma related to them and to allow for inclusion and belonging to prevent marginalisation.

Impact goal: Growth environments promote stress management

Emotionally significant changes in the environmental stimuli increase alertness and trigger a biological stress response. Stress responses are related to various physiological changes in different areas of the body. Their purpose is to help the person to survive situations that increase alertness by providing additional resources. The ultimate goal is to overcome or avoid the experienced danger and to restore physiological balance. Stress and stress responses are useful and necessary and they provide the required mental and physical energy to survive in challenging situations. Stress responses increase the sensitivity of senses and the level of activity and provide muscles with more energy.

However, prolonged or very intense stress, especially when associated with poor recovery and individual tolerance, is harmful to the developing brains of children and young people that are much more sensitive to the effects of stress responses than adult brains. Excessive stress can lead to a disturbance of the normal maturation of the child's brain. In particular, it disturbs the development of the prefrontal cortex and executive functions. Behaviour without executive functions is reactive, impulsive and uncontrolled. The prerequisites for purposeful information processing and learning are poor.

Adults have a critical role in establishing factors that protect children and young people from stress and in the process of learning how to control stress. Stress management should be practised with appropriately stressful situations and adversities. Sufficiently safe situations can also teach how to move forward from unpleasant situations and emotions.

Stress management can only be learned in relation with other people. As the co-regulation with an adult is internalised, stress management becomes conscious through developing executive functions. The child learns how to be patient, limit their reactions and control their fight or flight response. The adult must be cordial and warm while maintaining an appropriate level of standards. Overwhelming, uncontrolled and too intimidating experiences can scar the brain permanently. The situation is particularly difficult if there is excessive or prolonged stress or if several unpleasant situations are in process simultaneously. Lack of co-regulation with an adult when the child or young person needs it can weaken brain health.

The bodily changes caused by stress responses create a rising wave of stimuli towards the limbic system of the brain. How to deal with bodily changes and the emotional expression of changes in different cultural contexts are learned through interaction. For example, when a child is startled, their body undergoes the fight or flight response. The body is alert regardless of whether the danger is real or not. In most cases, there is no immediate danger. What happens next depends on the responses of the adults near the child. If the child's response repeatedly triggers responses related to anxiety in adults, the child's emotional relationship with becoming startled will slowly develop into anxiety. On the other hand, if there are signs of safety in interaction, it shows that everything will be okay. Interaction that provides safety teaches the child the skill of controlling and delaying responses. This is at the core of learning, being patient and flexible social interaction.

The biological roots of emotional regulation are in the ability to control stress responses. Stress responses are controlled in a complex interaction between the autonomic nervous system, the amygdalae, the hypothalamus and the nerves of the hippocampus that begins to develop during the foetal stage. If the mother experiences intense, prolonged stress during pregnancy, it can weaken the baby's developing control system. This makes the baby sensitive to threat signals already at birth as the stress hormone level affecting the functioning of the nervous system has been too high in the foetal stage. The brain learns to become alert even when triggered by the slightest stimulus. Children growing in stressful environments (with child poverty, excessively demanding parents, job

stress experienced by parents, intermittent interaction) typically receive too little guidance when their emotions change rapidly.

Outcome objective: Understanding of the prerequisites for brain health associated with growth and development has increased and it guides the development of growth environments

The objective is that, by the end of the decade, the understanding of parents, the media, various growth environments, family service professionals and free time activity providers about the parameters related to the growth of children and young people, especially the development of stress management, has increased. In order to accomplish this objective, the content of education and training related to early childhood education and teacher training must be changed and awareness of and respect for brain health must be increased. It is important to ensure that digitalisation does not take up time from the functions necessary to the development of the brain. If this is the case, children and young people can better tolerate making an effort, boredom and delayed gratification.

In growth and learning environments, it must be ensured that safety, balance and gratification are restored sufficiently quickly. This requires the presence of an adult and sensitive observation of the changes in the stress level of children and young people. Restoring safety means that the danger has been overcome or avoided and gratification is achieved.

The inability to focus and concentrate has become more and more common in general. In a rapid growth and learning phase, this may cause accumulating harm, in particular, to the development of executive functions. The brain needs to grow in peace and an environment where it can stop for a moment without being triggered to act. Growth and development environments must provide an opportunity to practise without offering too fast or immediate rewards. Immediate rewards provide quick gratification, which leads to lower activity.

Patience and the ability to delay gratification are associated with positive outcomes in learning, working life and physical and mental well-being. Numerous studies show that the importance of the ability to delay gratification in relation to these outcomes is larger than, for example, the individual's level of intelligence or socioeconomic background. It is also known that the skill depends on the environment and its predictability. Conversely, excessive cognitive stress can weaken the ability to delay gratification (Wiehler et al., 2022). The

risk associated with learning environments that focus on entertainment, rewards and personal interest is that the ability to pause, listen and focus deteriorates.

Modern society provides a plethora of opportunities to make choices from increasingly attractive alternatives. There are plenty of sources of immediate gratification that are promoted through various channels. Diversity, variety, digitalisation and transition agility are considered important aspects of learning environments. Monotonicity and boredom are avoided and repetition is thought to slow down the learning process. However, the brain of a young child is not ready to act in an environment that emphasises the child's personal interests, choices and a quick tempo. Young children need a lot of guidance from adults and sparking an interest in things that are necessary for the future, even if they do not provide immediate gratification.

Controlling stress automatically restores the balance of the body and mind. Stress management develops as emotional regulation improves. Emotional regulation improves as executive functions develop in an appropriately demanding and supportive environment.

Prerequisites

- Researched information on the prerequisites for children's and young people's brain health
 - is included in all forms of teacher training and education
 - is taken into account in curricula and learning environments
 - is actively used by early childhood education operators and teachers
 - affects the operating cultures of children's and young people's families and other growth environments
 - guides healthcare and social services
 - increases the measures taken to promote healthy lifestyles for children and young people

Outcome objective: Operating environments take brain ergonomics and age-appropriate level of development into account

The demands for children and young people in school and free time activity environments have increased and overactivity, excessive stress and even burnout are threats to many. Digital devices are in constant use both in learning environments and in free time and social interaction is heavily based on the use of these devices. Conversely, digital devices also provide many opportunities as tools for learning and spending free time. It is important to take the special characteristics

of the development and different stages of children's and young people's brains in different operating environments and cultures, especially learning environments.

Curricula must take the special characteristics of different development stages of brain functions into account. It is important that the demands placed on children and young people are in line with their development phase and that the overall demands of life are not excessive with regard to school and free time activities. In addition, the importance of sufficient rest and recovery must be taken into account and healthy stress management must be supported.

Establishing brain ergonomic operating environments and cultures is heavily based on brain health and well-being awareness and understanding and its practical implementation, which is why this objective is also closely linked to the objective 1. Brain ergonomics also allows for appropriate balance between stress and recovery, which, in addition to the risk of burnout, is likely to reduce the risk of various harmful stress management mechanisms, such as substance abuse.

Prerequisites

- Adults take children's and young people's age-appropriate executive functions into account and safeguard their development
- Cooperation between growth and learning environments and various services ensures that safe daily life of children in various situations involving stress and change
- Harmful stress in children's and young people's lives is identified and reduced
- Curricula take into account age-specific development stage and secure children's right to enhanced or special support
- Opportunities for an adult's sufficient and warm presence and interaction are supported

Outcome objective: The adequate quality and amount of sleep according to the level of development is ensured

Children and young people need to get enough sleep according to their age. Sufficient sleep supports learning and well-being, whereas inadequate sleep may cause challenges with concentration and expose children and young people to various health hazards and diseases, such as obesity, depression and diabetes. Free time activities, use of digital devices and various other social and environmental factors taking place or occurring in the evening may postpone bedtime and the leaving for school or daycare in the morning may be too early. In these cases, the child does not get enough sleep. Circadian rhythm disorders are also common. In addition, children and young people may experience insomnia or other sleep disorders, such as sleep apnoea, which require appropriate assessment and treatment.

Prerequisites

- Other activities do not interfere with falling asleep or the amount and quality of sleep (for example, digital devices, free time activities in the evening, trouble at home)
- The need for sleep at different ages is taken into account
- The circadian rhythm of young people is taken into account
- The sleep disorders of children and young people are identified and treated

Outcome objective: Experiences of belonging and safety have improved

The sense of belonging to a community is the cornerstone of human behaviour. It can be felt only through other people. A person is seen and heard when they feel they are important to something greater than themselves, such as other people. The sense of belonging to a community provides psychological safety and it is associated with various positive emotions, whereas exclusion is associated with negative emotions, a sense of threat and stress. Consequently, feeling like a part of a community also has favourable effects on brain well-being.

The COVID-19 pandemic increased the sense of loneliness and weakened the sense of inclusion among young people (Kekkonen et al., 2022).

Prerequisites

- The sense of loneliness is reduced and children and young people have access to fixed groups and support for grouping and making friends in early childhood education, at school and in free time
- Rewarding activities where children/young people feel safe and are able to have an influence are made possible and created together with children and young people
- The sense of normality is expanded and prejudices related to developmental challenges are less common
- Psychological and physical violence (bullying) and harassment as well as discriminatory language and rejective interaction is addressed immediately



Outcome chain: brain health of children and young people

NEED	IMPACT GOAL	OUTCOME OBJECTIVES	PREREQUISITES
<p>Taking care of brain health safeguards peaceful growth and creates prerequisites for lifelong well-being</p>	<p>Children and young people have growth environments that support stress management</p>	<p>Understanding of the prerequisites for brain health associated with growth and development has increased and it guides the development of growth environments</p> <p>The environments of children and young people take brain ergonomics and their age-appropriate development into account</p> <p>Children's and young people's experiences of belonging and safety have improved</p> <p>Children and young people get enough refreshing and restorative sleep</p>	<ul style="list-style-type: none"> • Researched information on the parameters of children's and young people's brain health <ul style="list-style-type: none"> - is included in early childhood education and care training and teacher training - is taken into account in the curriculum and learning environments - is actively used by early childhood education and care actors and teachers - affects the cultures in children's and young people's families and other growth environments - guides healthcare and social services - there is a better understanding of how important a healthy lifestyle is to brain health • Adults take children's and young people's age-appropriate executive functions into account and safeguard their development • A child's effortless daily life in different situations involving stress and change is ensured with cooperation between the growth environment and services, growth and learning environments are brain-ergonomic • Age-appropriateness and individual differences in development are taken into account in the curriculum • Harmful stress in children's and young people's lives is identified and reduced • Opportunities for an adult's sufficient and warm presence and interaction are supported • Children and young people have access to fixed groups and support for grouping and making friends in early childhood education, at school and in free time • Rewarding activities where children/young people feel safe and are able to have an influence are made possible and created together with children and young people • Psychological and physical violence (bullying) and harassment is addressed immediately • Other activities do not disturb falling asleep or the amount and quality of sleep (digital devices, free time activities in the evening) • Young people's circadian rhythm is taken into account

Working-age population



Need: Taking care of brain health supports work ability and mental health and prevents brain diseases and exhaustion

In addition to various brain diseases, the brain well-being of the working-age population is threatened by too little sleep or the poor quality of sleep, excessive stress in daily life and exhaustion. Furthermore, the risk factors that expose the working-age population to brain diseases may slowly increase the risk of brain diseases in general and memory disorders in later stages of life. Early-onset memory disorders and other brain diseases and injuries can weaken brain health, work ability and functional capacity. A balance between stress and recovery that emphasises restorative sleep and good brain ergonomics is essential in supporting the brain health of all age groups, but it is particularly important among the working-age population exposed to pressure from work, unemployment and family life.

Conversely, better awareness of brain health and brain diseases is very important for supporting brain health and well-being at workplaces, healthcare services and society in general as well as through the choices made by the individual. Better awareness also plays an important role in reducing the stigma related to brain diseases, which contributes to better inclusion and brain well-being among those with a brain disease. Improved brain health awareness and skills is important as information about brain-economic, humanly sustainable working methods (K. Hartikainen, 2021; Pohjonen, 2022). Furthermore, workplaces and healthcare service providers need better, more in-depth understanding of how employees with partial work ability due to a brain disease or a disorder affecting the brain should be taken into account with regard to duties, equipment, work practices and work environments so that they can feel included and contribute to society to the best of their ability. Attention should also be paid to the unemployed and their social contacts and communities.

Impact goal: Work and operating environments enhance the health and well-being of the brain

Outcome objective: Brain health knowledge directs the practical activities of both individuals and communities as well as political decision-making

Everyone has information about brain health and its maintenance and promotion. All members of the working-age population have the opportunity to make choices that promote brain health. The focus of the objective is on factors that protect brain health and well-being. Risk factors are addressed at an early stage. The purpose is to aim for as good integrity of the brain as possible and positive activities here and now with consideration for individual parameters. In other words, the aim is not to only prevent diseases in the future. In addition to factors that protect the brain, early and efficient prevention, diagnosis and treatment of brain diseases and injuries according to guidelines is important. Reducing the risk of brain diseases is taken into account in an early stage (Table 1).

Taking into account harmful factors and risks that reduce brain health is not only important in the prevention of brain diseases but also in securing the optimal structure and functioning of the brain. Reducing harmful changes that disturb the structure and functioning of the brain (Debette et al., 2007; Sachdev et al., 2008) is important regardless of whether the diagnostic threshold of a brain disease is exceeded in the future or not or whether the person will suffer from a brain disease or not. Correspondingly, the prevention of high blood pressure, diabetes, metabolic disorder and substance addiction, for example, and quitting smoking as well as early and efficient treatment support brain health by, for example, reducing the harmful changes caused by white brain matter that develop slowly over several years (Brown et al., 2021; Dickie et al., 2016; Williamson et al., 2018). This, in turn, supports brain health and well-being as well as information processing functions in the short term while reducing the risk of cerebral infarction and memory disorders.

In addition to raising and establishing brain health awareness, increasing and taking this awareness into account in practice is also important. Brain health awareness reduces the stigma related to brain diseases and, on the other hand, actively used information supports the social and working life inclusion and agency of those who suffer from a brain injury or brain disease. People in various executive positions have the information and ability to build environments that support brain health and well-being.

In addition to conventional risk factors, awareness about the effects of excessive cognitive and affective (information processing and emotions) stress on brain health and the information processing and emotional functions of the brain needs to be raised. People also need information about the effects of psychological and social factors that protect the well-being of the brain.

Prerequisites

- Brain health knowledge, skills and appreciation are increased through research, education and development
- Researched information is accessible, and it is utilised systematically
- Brain health is considered in assessing the health and well-being effects of the decisions in society
- An individual has the opportunities and incentives to make choices that promote their brain health in their daily life (e.g., a healthy lifestyle, how they spend their time)
- National guidelines are complied with in the prevention, diagnosis and treatment of brain damage, stroke and memory disorders

Outcome objective: Work and operating environments take brain ergonomics into account

Future work environments should support brain ergonomics. Good brain ergonomics consists of cognitive, information and affective ergonomics. With the means of brain ergonomics, unnecessary stress of the brain is avoided, whether the stress is related to information overload or working methods, environment or equipment that do not take into account the limits of the brain's cognitive functions or the nature of affective functions. The brain is the most important resource and tool used in working life, so it is important that it is used sustainably, adequate recovery is ensured and working methods, environments, cultures and equipment that genuinely support

sustainable well-being of the brain are provided and established (K. Hartikainen, 2021; Pohjonen, 2022). Brain health and well-being must also be highlighted from the perspective of occupational safety.

The health hazards of modern working life are closely linked to excessive stress of the brain without adequate recovery, which has multi-faceted harmful effects on general health and brain health. Brain stress may cause exhaustion, depression, anxiety, insomnia, pain in the musculoskeletal system as well as various other diseases and symptoms. Job burnout is a common threat and the symptoms related to it have become more common during the COVID-19 pandemic (How is Finland doing? | Finnish Institute of Occupational Health, 2022). It is also important that the executive function capacity of an individual is not exceeded as a result of unnecessary threats related to exclusion from community and that everyone can feel that they are a respected and valued member of a community. The stress of the brain's executive functions must also be considered in brain ergonomics. (K. Hartikainen, Pihlaja, & Kolonen, 2021; K. Hartikainen, Pihlaja, Räsänen, et al., 2021.)

Prerequisites

- Family life, studying, working, free time activities and digital environments must be balanced to ensure the well-being of the brain
- Brain ergonomics (cognitive, affective and information ergonomics) is taken into account in different services and service environments
- Services are cognitively accessible, i.e. easily understandable and available, so that persons with challenges related to information processing can access them
- Key people in organisations make supporting brain ergonomics part of the work routine, systemic leadership and working that takes brain ergonomics into account is ensured at workplaces
- The statutory occupational safety and health inspections, workplace surveys and learning environment inspections include brain ergonomics and the functionality of the work community and the monitoring of brain health is included in the assessment of work ability

Outcome objective: The working-age population gets enough refreshing sleep

This outcome objective emphasises that individuals have the information, skills and opportunities required in order to get enough sleep.

Sleep is a vital factor in securing the integrity and proper functioning of the brain. Normal 6 to 8 hours

of sleep every night supports the thickness of the cerebral cortex, the integrity of white matter and good executive functions (Tai et al., 2022). The effect of sleep on brain health is multi-faceted. One of the key effects is related to the waste management system of the brain, which the glymphatic system of the brain is responsible for. The brain is cleansed of waste products during sleep as a result of intensifying vasomotor and respiratory brain pulsations. In Finland, the Kiviniemi research group has been awarded for their studies related to these mechanisms (Helakari et al., 2022). Inadequate sleep compromises the structure and functioning of the brain, partly as a result of poor cleaning mechanisms, which may lead to memory disorders in the worst case scenario.

Inadequate sleep also exposes the individual to anxiety, depression and various other diseases and increases the risk of accidents. Furthermore, inadequate sleep weakens the brain's alertness, memory, executive and emotional functions. The reasons behind inadequate sleep may be related to insomnia or other sleep disorders or, in some cases, simply the fact that not enough time is reserved for sleeping.

Insomnia and sleep apnoea are major health-related and social challenges. In Finland, it is estimated that up to 30% of the population may have at least mild sleep apnoea. Moderate or severe sleep apnoea affects 17% of middle-aged men and 9% of women (Sleep apnoea, Current Care Guidelines 2021). Sleep apnoea is related to considerable increase in the onset of diseases and poor quality of life. According to the Organisation for Respiratory Health in Finland, severe sleep apnoea increases the likelihood of dying from cardiovascular diseases, stroke or pulmonary hypertension 3–6-fold. Even mild sleep apnoea is associated with an increased risk of hypertension. The reason behind daytime tiredness or even job burnout may be undiagnosed sleep apnoea. If untreated, sleep apnoea can be a major stress factor. Sleep apnoea weakens recovery during sleep and causes stress responses during the night.

Thus, sleep apnoea has various direct and indirect harmful effects on brain health and well-being. Insomnia may also result from undiagnosed sleep apnoea and various drugs used in the treatment of insomnia can make sleep apnoea worse. Typical symptoms of sleep apnoea that weaken both well-being and work ability include daytime tiredness, memory problems, challenges with concentration and mood disorders. In order for patients with mild or moderate sleep apnoea to be better diagnosed and for them to receive better guidance and treatment related to sleep apnoea and sleep disorders in general, the importance of sleep to brain well-being must be



better taken into account and general awareness and resources for the efficient and early diagnosis and treatment of sleep disorders must be increased. Refreshing and restorative sleep is a major resource factor. Refreshing sleep allows for good energy levels and recovery from stress. Refreshing sleep is the key foundation for the health and well-being of the mind and brain.

Prerequisites

- Sleep is appreciated and the working-age population has the opportunity to get enough sleep
- Health professionals, workplaces and, more broadly, social actors have the knowledge, skills and resources to promote refreshing sleep
- Investments in measures aimed at preventing sleep disorders are made
- Sleep disorders and the factors behind insomnia, such as diseases (e.g. sleep apnoea), stressful life situation (family life, other life situation, job stress) and environmental stimuli (noise) are surveyed and diagnosed in primary health care and occupational health care services
- The balance of daytime recovery and stress is ensured (workplaces and other environments)

Outcome objective: Fellow citizenship is strengthened—The opportunities and abilities related to inclusion and the experience of inclusion and togetherness have increased

In order to accomplish the objective, workplaces and other communities for the working-age population must have in place an operating culture that supports the sense of belonging through concrete measures.

The sense of belonging is the most important basic psychological need. Its importance to the brain and brain health is multi-faceted. The sense of belonging or the lack thereof (exclusion) may have a direct and indirect effect on the functioning and health of the brain.

In psychologically safe environments, people experience a sense of belonging, which consists of experiences of being heard and seen that are important for individuals and human nature. Being certain that you belong to a group reduces negative stress, which, in turn, reduces the need for recovery. Thus, the overall psychophysiological-social balance is easier to maintain or restore. Studies show that, in psychologically safe work environments, people recover already during the working day.

An additional effect of experiencing a sense of belonging and fulfilling this need is that the quantitative and qualitative nature of the thinking and behaviour of individuals and communities is better, more satisfying and more effective. According to studies, psychologically safe communities are more energetic, efficient, creative and productive and make fewer errors (Delizonna L. High-Performing Teams Need Psychological Safety. Here's How to Create It. Harvard Business Review, 2017. - Google Search, 2017; Edmondson & Lei, 2014). Furthermore, they support occupational well-being, which results in fewer sick leaves, for example. Workplaces that can provide psychological safety and meet the human need of belonging to a community increase the well-being of the employees and the relevance of the job. Employees are more committed to these workplaces, which results in less frequent quitting. In addition, they increase general satisfaction with life and happiness and the job supports positive mental health even in exceptional times (pandemics, remote work).

Conversely, exclusion increases the experience of insecurity and being under threat. Working life studies show that cognitive processes are poorer when the level of psychological safety is poor. In practice, this manifests as poor memory, problem solving skills, learning and thinking as well as weaker metacognitive skills. The willingness to take risks is lower, which means that the problem solving capacity and creativity are worse.

People react easily to social contexts. The sense of exclusion triggers the brain's threat mechanisms, which make selective attention poorer and, consequently, directly debilitate various decision-making processes. Furthermore, the sense of exclusion stresses the brain through stress hormones, which results in poorer self-efficacy and self-satisfaction (poor self-image). Agency in society becomes poorer as a result of multiplier effects (for example, increased need for recovery due to a threat associated with increased sleep disorders caused by stress).

One of the most significant phenomena of our era in the past decades has been the rise of individualism in our society. This change has occurred simultaneously with the outbreak of depression and anxiety symptoms and problems with work ability. At its worst, individualistic culture can underline the experiences of exclusion and the assumption and idealisation of that you have make it on your own. According to the Loneliness in the Workplace 2022 survey conducted by HelsinkiMissio, 25% of Finns experience loneliness in working life and one in six experience exclusion in their work community.

Workplaces and work communities are the typical communities of the working-age population. The COVID-19 pandemic introduced and established hybrid and remote methods of working as alternatives to in-office work, in which particular attention towards the formation of a work community must be paid. It is also important to take into account the unemployed so that they can belong to a community that supports brain health through its activities. Furthermore, it is necessary to consider other communities of the working-age population, such as family, relatives, free time activities and volunteering.

Belonging to a community or a group supports brain health reactively and proactively by making it possible to meet the most important basic psychological human need in work and free time communities. Studies show that operating cultures that are oriented from oneself towards others support and generate gratification, joy, happiness, health, capabilities, creativity and better energy levels.

Prerequisites

- Increasing awareness, skills and discussion of the importance that communities and positive sociability have for brain well-being and good quality of life
- Appreciation of operating cultures and communal cultures that are oriented from oneself towards others increases
- Means for improving the sense of belonging in different aspects of life are discovered
- Stigma related to brain diseases and brain injuries is reduced

Outcome chain: brain health of the working-age population

NEED	IMPACT GOAL	OUTCOME OBJECTIVES	PREREQUISITES
<p>Taking care of brain health supports work ability and mental health and prevents brain diseases and exhaustion</p>	<p>Operating environments of the working-age population enhance the health and well-being of the brain</p>	<p>Appreciation of and familiarity with brain health guides political decision-making and practical actions</p> <p>The environments of the working-age population take brain ergonomics into account</p> <p>The opportunities and abilities related to inclusion and the experience of inclusion and togetherness have increased, fellow citizenship</p> <p>The working-age population gets enough refreshing sleep</p>	<ul style="list-style-type: none"> Brain health knowledge, skills and appreciation are increased through research, education and development Researched information is accessible, and it is utilised systematically Brain health is considered in assessing the health and well-being effects of the decisions in society An individual has the opportunities and incentives to make choices that promote their brain health in their daily life (e.g., a healthy lifestyle, how they spend their time) National guidelines for the prevention, diagnosis and treatment of brain damage, stroke and memory disorders are complied with Home, studying, work, free time activities, the digital world; balancing these areas while considering brain well-being Brain ergonomics (cognitive, affective and information ergonomics) are taken into account in the accessibility of different services; cognitive accessibility Key people in organisations make supporting brain ergonomics part of the work routine, systemic leadership and working that takes brain ergonomics into account is ensured at workplaces The statutory occupational safety and health inspections, workplace surveys and learning environment inspections include brain ergonomics and the functionality of the work community and the monitoring of brain health is included in the assessment of work ability Increasing awareness, skills and discussion of the importance that communities and positive sociability have for brain well-being and good quality of life Appreciation of operating culture and communal culture that are oriented from oneself towards others Means for improving the sense of belonging in different aspects of life are discovered Reducing the stigma associated with brain diseases and brain damage Sleep is appreciated and the working-age population has the opportunity to get enough sleep Health professionals, workplaces and, more broadly, social actors have the knowledge, skills and resources to promote refreshing sleep Measures preventing sleep disorders are invested in Sleep disorders and factors behind sleeplessness (city planning, noise nuisances, family situation and other situations in life) are screened and recognised in primary health care and occupational health service The balance of daytime recovery and stress is ensured (workplaces and other environments, “recovery bonus”)

The elderly



Need: Taking care of brain health supports well-being, functional capacity and quality of life

Society's burden concerning brain injuries increases with age. The elderly are at a higher risk of stroke and progressive neurological disorders, such as memory disorders, and the prevalence of these is higher among the elderly. Head injuries resulting from problems with balance and falling over are one of the threats to brain health among the elderly and those with multiple diseases. The age group of the elderly is large and heterogenic with regard to age, health, functional capacity and various other factors. The proportion of the elderly of the whole population will continue to grow in the following decades. In addition to preventing brain diseases, it is important to slowly draw the attention to progressive changes in the brain that may be related to the onset of a disease or ageing. They can lower the individual's functional capacity even if a brain disease cannot be diagnosed. These challenges and risks emphasise the importance

of promoting brain health among the elderly and safeguarding the protective factors. However, ensuring the brain health of the elderly is not only about the prevention of future threats and diseases, but also involves the optimisation of the current state of well-being and functional capacity.

Impact goal: A society that appreciates the elderly, makes autonomy possible and takes care of safety

Appreciation of the elderly and, first and foremost, their equality with other demographic groups, should be apparent in our society so that age discrimination in its various forms did not exist and the elderly were seen as a resource. A society that allows for autonomy takes into account physical functional capacity and information processing functions and provides the individual with authority and supports autonomy where possible and safe regardless of their functional capacity and level of memory functions.

A society that allows for autonomy also offers the opportunity to take part in free time and cultural activities, associations and social decision-making processes. A society that takes care of safety guarantees sufficient care and treatment and an appropriate, safe living environment. When an individual feels safe and valued and is able to exercise autonomy, the mind's well-being is supported, which has a strong link with brain health.

Outcome objective: Brain health information is in optimal use

The Finnish FINGER study is the first extensive intervention study in the world that shows that adopting a healthy lifestyle prevents the deterioration of the memory functions of the elderly (Ngandu et al., 2015). A programme that includes physical activity, nutritional counselling, memory training, social interaction and monitoring of the risk factors related to cardiovascular diseases also improves quality of life (Strandberg et al., 2017), reduces the prevalence of chronic diseases (Marengoni et al., 2018) and prevents challenges related to the ability of carrying out basic daily tasks (Kulmala et al., 2019). The FINGER study also helped develop the FINGER operating model, which is recommended to be applied widely by the National Programme on Ageing (Ministry of Social Affairs and Health, 2020). According to the FINGER operating model, lifestyle counselling is provided to people at an increased risk of memory disorders as a preventative method. Estimates show that, globally, 40% of memory disorder cases could be prevented by addressing 12 factors related to lifestyle (Livingston et al., 2020). These factors are less education, hypertension, obesity, alcohol, traumatic brain injury (TBI), hearing loss, smoking, depression, physical inactivity, social isolation, diabetes, air pollution (see Table 1 about the preventative methods of brain diseases). However, the effect of lifestyle on memory disorder risks has been reviewed in the memory disorder prevention guidelines of the World Health Organization (2019) and only few factors had a strong recommendation related to them. With regard to physical activity, the evidence behind the effect of reducing the risk of memory

disorders was the strongest. Other factors that gained a strong recommendation with qualitatively varying evidence included the treatment of hypertension and diabetes (through lifestyle changes or medication) and quitting smoking. Nevertheless, the best results in preventing memory disorders is achieved by addressing different lifestyle factors simultaneously.

While the general awareness of the factors related to brain health has increased, understanding of the mechanisms behind diseases has also improved. In principle, brain diseases involve multiple factors and they are affected by various genes, environmental factors, lifestyle and the complex interaction between these. The onset mechanisms of several brain diseases remain unknown. Some mechanisms have lately become particularly interesting topics of research, for example, chronic low-grade inflammation, which is believed to play a role behind various diseases ranging from Alzheimer's disease to cancer and cardiovascular diseases (Furman et al., 2019). Cardiovascular diseases, in particular, are a key risk factor of memory disorders. What is good for the heart is also good for the brain.

Increasing awareness and information about the factors related to brain health is important. It is vital that the elderly make choices that support their cognitive capacity and brain health. Their environment needs to make it possible to make such choices. Ageing is often associated with accepting care and treatment. It is important that the awareness and understanding of the persons in charge of planning and providing care and treatment about the importance of brain health is increased. Vital aspects include matters related to lifestyle and reducing age discrimination and the stigma related to memory disorders. Memory disorders are diseases like any other disease and involvement in regular social and societal activities should not end with a diagnosis.

Prerequisites

- The importance of lifestyle is known and it is taken into account in decision-making processes
- The continuity of brain health research is secured
- Both people themselves and professionals have extensive, multichannel and centralised access to information about brain health
- The training and education of those involved in the operating environments of the elderly is developed
- National guidelines for the prevention, diagnosis and treatment of brain damage, stroke and memory disorders are complied with

Outcome objective: The environments of the elderly take brain ergonomics into account

The ageing processes of the brain are multi-faceted and begin at an early age. The volume of the brain starts to decline at the age of 30–40 and the rate of decline increases approximately at the age of 60, which may be seen in the structures central to information processing functions, such as the hippocampus and the frontal lobe. Vascular lesions start to develop in the white matter and cellular changes related to various brain diseases may occur before the onset of the diseases or even if the disease never occurs. There are also changes related to neurotransmitter systems. The elderly are a major part of the population and some of the ageing processes of the brain start at an early age, but they have the most significant impact beginning from middle age. Consequently, these changes and other matters related to ageing also concern large parts of the working-age population. Changes resulting from ageing may be either normal or related to disease processes. Although even healthy ageing is associated with changes in information processing functions, major changes are typically related to brain diseases, the prevalence of which increases significantly with age.

Good brain ergonomics at workplaces also makes it possible for the elderly to contribute. Brain ergonomics should also be paid attention to in digital and other services to support the accessibility of services, particularly cognitive accessibility. Good brain ergonomics in the operating environments of the elderly also supports the inclusion and social agency of the elderly and it is necessary for the genuine equal treatment of the elderly.

Operating environments must support autonomy and agency. A brain-friendly environment also makes it possible to maintain agency. Agency refers to the experience of having the opportunity to accomplish something and the perceived ability to function. Individuals can control their motor functions and make choices of their own that affect their immediate or wider exterior environment. Agency is a significant factor affecting health and quality of life. The aim is to provide a better opportunity to live a life of your own, which will provide individuals with the ability and opportunity to make conscious choices about their life direction within their environment.

Prerequisites

- Challenges posed by ageing and brain diseases are taken into account
 - Physically and cognitively accessible living and operating environments; accessible public transport
 - Services are cognitively accessible (particularly digital services) and alternative services are available, if necessary
 - Changes in sensory functions are taken into account (particularly sight and hearing)

Outcome objective: The elderly get enough refreshing and restorative sleep

Adequate, refreshing and restorative sleep is a resource that supports the resilience to cope with life challenges and adversities, helps alleviate and tolerate chronic pain and supports emotional regulation, mood and information processing functions. Conversely, inadequate sleep considerably weakens brain health, mood and quality of life as well as the opportunities to be an active, energetic operator.

Challenges related to sleep are common among the elderly and have various backgrounds. Inadequate, poor sleep may be related to various factors such as pain, overactive bladder, sleep apnoea or other sleep disorders or environmental factors, such as a restless family member under family care. In most cases, sleep apnoea gets worse with age. Due to their various backgrounds, the assessment and treatment of sleep disorders requires time and effort. Challenges with sleep and some sleeping pills also cause problems with information processing and, in particular, memory, attention and executive functions. Lack of sleep exposes the individual to challenges related to emotional and mood regulation, depression and anxiety. Insomnia can lead to depression and, conversely, depression can lead to insomnia. Poor sleep also lowers the pain threshold. Pain can make the quality of sleep worse and poor sleep can increase the sensation of pain. Inadequate, poor sleep leads to various vicious cycles that contribute significantly to poor brain health.

At the moment, health care units and nursing homes rarely have the time to properly monitor the quality of sleep of the elderly. Many suffer from sleep apnoea without even knowing it. The screening of sleep apnoea in primary health care should be improved. Furthermore, awareness of the various health effects of sleep both among social and health care professionals and the elderly should be increased. More general mapping of the quality and amount of sleep and sleeping support is needed. The Current Care Guidelines for insomnia (2020) state that the diagnosis

of insomnia is primarily based on a careful patient history, a clinical examination and a sleep journal and the treatment of acute insomnia is primarily based on non-pharmaceutical methods. In practice, it has not been possible to allocate health care resources in a way that allows for complying with the Current Care Guidelines properly.

Problems in the musculoskeletal system and various other types of pain experienced by the elderly are common, in addition to which an overactive bladder causes many to wake up frequently in the middle of the night. Those responsible for providing family care also do not typically get enough uninterrupted sleep. It is also possible that the circadian rhythm of the elderly in poor condition in care units may be disrupted if daytime activity is not ensured or if the rhythm is based on the employee resources of the care unit instead of the circadian rhythm of the residents. In some cases, even seemingly minor activities aimed at maintaining the circadian rhythm allow for adequate, refreshing and restorative sleep from the perspective of brain health.

Prerequisites

- Sleep apnoea and other causes of sleep disorders are taken into account
- Non-pharmaceutical modes of treatment are more frequent in the treatment of insomnia
- Refreshing sleep is also ensured in care units

Outcome objective: Experiences of inclusion and meaningfulness have increased

Inclusion can be considered as an emotion a person feels when they feel that they are part of the social network of a community. The size of the lower middle prefrontal cortex is linked to the width of the social network and eye contact alone strongly stimulates the areas of the brain regulating the sensation of gratification. Rich social contacts seem to be linked to the better connection with networks and the larger diversity of nerve cells. Strong inclusion is closely linked to reduced feeling of loneliness. Loneliness is self-perceived, stress-generating imbalance between the individual's desired and actual social relationships. It can be thought of as an alarm that encourages seeking and maintaining social relationships. Loneliness is not the same as living alone or being alone, which may be experienced as beneficial. Social isolation may also lead to poor well-being. Social isolation refers to a low number of social relationships or the lack of interactive relationships, for example. Social networks typically become smaller with age. In Western countries, approximately one in every four or every three people aged over 70 experience loneliness. In Finland, more than one in three of the elderly experience loneliness at least occasionally.



Prolonged loneliness may lead to a downward spiral that has harmful and far-reaching consequences on health. Loneliness may be a result of diseases or physical inactivity, but it may also accelerate the progress of diseases. Loneliness weakens the individual's resilience and ability to control stress considerably. Loneliness is associated with high morbidity (Barnes et al., 2022) and unhealthy lifestyles. Loneliness may reduce life expectancy and it is considered to be as harmful to health as smoking or obesity (Freedman et al., 2020; Holt-Lunstad et al., 2010b). Loneliness can also lead to depression (Adams et al., 2004), which may increase the body's rate of ageing faster than general population. Loneliness seems to weaken cognitive functions and increase the risk of memory disorders, but the mechanism is not related to the known neuropathology of these disorders (Wilson et al., 2007). Memory disorders may narrow down social networks and increase loneliness. Conversely, loneliness can increase the rate of progress of memory disorders.

Belonging to social groups supports experiences of happiness and general satisfaction with life. Social contagion studies show that well-being can spread indirectly through social networks to the people at the periphery of the network. Correspondingly, loneliness is contagious and can advance in social networks through structural changes or changes experienced by individuals.

Studies show that the perceived meaning of life is associated with better health and well-being (Czekierda et al., 2017) as well as lower morbidity (Alimujiang et al., 2019). Recent studies also support the view that the perceived meaning of life is associated with better memory functions (Sutin et al., 2021). People with Alzheimer's disease who feel that their life has meaning are also more likely to have better well-being (Dewitte et al., 2019).

Prerequisites

- Feelings of loneliness and insecurity are less common
- It is possible to participate in working life and the building of society
 - The elderly are better recognised as a resource
 - Lifelong learning is made possible
- Meaningfulness and the sense of life management are supported, also when functional capacity is limited
 - Operating environments and services support equality, autonomy, agency, well-being and health
 - Community continues throughout life
 - Prejudices associated with ageing and brain diseases have reduced
 - Rehabilitation is more extensively available to the elderly
 - Cultural and physical activity services are extensively available

Outcome chain: brain health of the elderly

NEED	IMPACT GOAL	OUTCOME OBJECTIVES	PREREQUISITES
<p>Taking care of brain health supports well-being, functional capacity and quality of life</p>	<p>A society that appreciates the elderly, makes autonomy possible and takes care of safety</p>	<p>Brain health information is in optimal use</p> <p>The environments of the elderly take brain ergonomics into account</p> <p>Experiences of inclusion and meaningfulness have increased</p> <p>The elderly get enough refreshing and restorative sleep</p>	<ul style="list-style-type: none"> • The importance of lifestyle is known and it is taken into account in decision-making processes • The continuity of brain health research is secured • Both people themselves and professionals have extensive, multichannel and centralised access to information about brain health <ul style="list-style-type: none"> - The training and education of those involved in the operating environments of the elderly is developed - National guidelines for the prevention, diagnosis and treatment of brain damage, stroke and memory disorders are complied with • Challenges posed by ageing and brain diseases are taken into account <ul style="list-style-type: none"> - Physically and cognitively accessible living and operating environments; public transport - Services are cognitively accessible (particularly digital services) and alternative services are available, if necessary - Changes in sensory functions are taken into account (particularly sight and hearing) • Feelings of loneliness and insecurity are less common • It is possible to participate in working life and the building of society <ul style="list-style-type: none"> - The elderly have been recognised better as a resource - Lifelong learning • Meaningfulness and the sense of life management increase, also as functioning becomes limited <ul style="list-style-type: none"> - Operating environments and services support equality, autonomy, agency, well-being and health - Communality continues throughout life - Prejudices associated with ageing and brain diseases have reduced - Rehabilitation is more extensively available to the elderly - Cultural and physical activity services are extensively available • Sleep apnoea and other causes of sleep disorders are taken into account • Non-pharmaceutical modes of treatment are more frequent in the treatment of insomnia • Refreshing sleep is also ensured in care units

Implementation plan

The group in charge of preparing and practical implementation of the National Brain Health Programme's implementation plan began its work in October 2022. The sections concerning children and young people, working-age population and the elderly were coordinated by the Central Union for Child Welfare, the Finnish Institute of Occupational Health in cooperation with the Sustainable Brain Health project of Tampere universities and the Age Institute, respectively. Folkhälsan was involved in the planning and implementation of all age group-specific processes where applicable.

In connection with setting the goals and objectives of the programme, the group already confirmed the idea that the programme's implementation in 2023 should focus on activities aimed at accomplishing the first outcome objective (Understanding of brain health, appreciation of brain well-being has increased). The objective has its own inherent value, in addition to which it is thought that by emphasising activities aimed at accomplishing it, the basis for carrying out activities that are prerequisites for accomplishing the three other outcome objectives. In 2023, the implementation of the programme will thus focus on training and education and, depending on the availability of resources, also on communications. In practice, this means increasing the availability of training related to brain health for the professionals in the social, health care and education sector, for example. The implementation plan for 2024–2029 will also be prepared in spring 2023.

Sources

- Adams, K. B., Sanders, S., & Auth, E. A. (2004). Loneliness and depression in independent living retirement communities: risk and resilience factors. *Aging & Mental Health*, 8(6), 475–485. <https://doi.org/10.1080/13607860410001725054>
- Aivoinfarkti ja TIA - Käypä hoito -suositus. (2022.) <https://www.kaypahoito.fi/kht00058>
- Aivovammat - Käypä hoito -suositus. (2022). <https://www.kaypahoito.fi/hoi18020>
- Alimujiang, A., Wiensch, A., Boss, J., Fleischer, N. L., Mondul, A. M., McLean, K., Mukherjee, B., & Pearce, C. L. (2019). Association Between Life Purpose and Mortality Among US Adults Older Than 50 Years. *JAMA Network Open*, 2(5). <https://doi.org/10.1001/JAMANETWORKOPEN.2019.4270>
- Barnes, T. L., Ahuja, M., MacLeod, S., Tkatch, R., Albright, L., Schaeffer, J. A., & Yeh, C. S. (2022). Loneliness, Social Isolation, and All-Cause Mortality in a Large Sample of Older Adults. *Journal of Aging and Health*, 34(6–8), 883. <https://doi.org/10.1177/08982643221074857>
- Brown, R., Low, A., & Markus, H. S. (2021). Rate of, and risk factors for, white matter hyperintensity growth: a systematic review and meta-analysis with implications for clinical trial design. *Journal of Neurology, Neurosurgery & Psychiatry*, 92(12), 1271–1277. <https://doi.org/10.1136/JNNP-2021-326569>
- Clasadonte, J., & Prevot, V. (2017). The special relationship: glia–neuron interactions in the neuroendocrine hypothalamus. *Nature Reviews Endocrinology* 2017 14:1, 14(1), 25–44. <https://doi.org/10.1038/nrendo.2017.124>
- Czekierda, K., Banik, A., Park, C. L., & Luszczynska, A. (2017). Meaning in life and physical health: systematic review and meta-analysis. *Health Psychology Review*, 11(4), 387–418. <https://doi.org/10.1080/17437199.2017.1327325>
- Debette, S., Bombois, S., Bruandet, A., Delbeuck, X., Lepoittevin, S., Delmaire, C., Leys, D., & Pasquier, F. (2007). Subcortical hyperintensities are associated with cognitive decline in patients with mild cognitive impairment. *Stroke*, 38(11), 2924–2930. <https://doi.org/10.1161/STROKEAHA.107.488403>
- Deci, E. L., & Ryan, R. M. (2009). The “What” and “Why” of Goal Pursuits: Human Needs and the Self-Determination of Behavior. https://doi.org/10.1207/S15327965PLI1104_01, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Delizonna L. (2017). High-Performing Teams need Psychological Safety. Here’s how to create it. *Harvard Business Review*. <https://hbr.org/2017/08/high-performing-teams-need-psychological-safety-heres-how-to-create-it>
- Depressio - Käypä hoito -suositus. (2022). <https://www.kaypahoito.fi/hoi50023>
- Dewitte, L., Vandenbulcke, M., & Dezutter, J. (2019). Meaning in life matters for older adults with Alzheimer’s disease in residential care: associations with life satisfaction and depressive symptoms. *International Psychogeriatrics*, 31(5), 607–615. <https://doi.org/10.1017/S1041610218002338>
- Diamond, A. (2013). Executive functions. In *Annual Review of Psychology* (Vol. 64, pp. 135–168). Annual Reviews Inc. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Dickie, D. A., Ritchie, S. J., Cox, S. R., Sakka, E., Royle, N. A., Aribisala, B. S., Valdés Hernández, M. del C., Maniega, S. M., Pattie, A., Corley, J., Starr, J. M., Bastin, M. E., Deary, I. J., & Wardlaw, J. M. (2016). Vascular risk factors and progression of white matter hyperintensities in the Lothian Birth Cohort 1936. *Neurobiology of Aging*, 42, 116. <https://doi.org/10.1016/J.NEUROBIOLAGING.2016.03.011>

- Edmondson, A. C., & Lei, Z. (2014). Psychological Safety: The History, Renaissance, and Future of an Interpersonal Construct. <https://doi.org/10.1146/Annurev-Orgpsych-031413-091305>, 1, 23–43. <https://doi.org/10.1146/ANNUREV-ORGPYCH-031413-091305>
- Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science*, 302(5643), 290–292. https://doi.org/10.1126/SCIENCE.1089134/SUPPL_FILE/EISENBERGER_SOM.PDF
- Erkkilä, M., Peräkylä, J., & Hartikainen, K. M. (2018). Executive functions and emotion-attention interaction in assessment of brain health: Reliability of repeated testing with executive RT test and correlation with BRIEF-A questionnaire. *Frontiers in Psychology*, 9(DEC), 2556. <https://doi.org/10.3389/fpsyg.2018.02556>
- Freedman, A., Coe, C. (, Fcfp,), & Nicolle, J. (2020). Social isolation and loneliness: the new geriatric giants: Approach for primary care. *Canadian Family Physician*, 66(3), 176. <https://pmc/articles/PMC8302356/>
- Furman, D., Campisi, J., Verdin, E., Carrera-Bastos, P., Targ, S., Franceschi, C., Ferrucci, L., Gilroy, D. W., Fasano, A., Miller, G. W., Miller, A. H., Mantovani, A., Weyand, C. M., Barzilai, N., Goronzy, J. J., Rando, T. A., Effros, R. B., Lucia, A., Kleinstreuer, N., & Slavich, G. M. (2019). Chronic inflammation in the etiology of disease across the life span. *Nature Medicine* 2019 25:12, 25(12), 1822–1832. <https://doi.org/10.1038/s41591-019-0675-0>
- Hartikainen, K. (2021, October 6). Aivotaloudellinen työtapa tukee aivohyvinvointia, työn laatua ja tuloksellisuutta. | Kestävä aivoterveys | Tampereen korkeakoulu-yhteisö. <https://projects.tuni.fi/kestavaaivoterveys/uutiset/aivotaloudellinen-tyotapa-turvaa-tyopaikan-tarkeimman-resurssin-eli-aivot/>
- Hartikainen, K. M., Ogawa, K. H., & Knight, R. T. (2000). Transient interference of right hemispheric function due to automatic emotional processing. *Neuropsychologia*, 38(12), 1576–1580. [https://doi.org/10.1016/S0028-3932\(00\)00072-5](https://doi.org/10.1016/S0028-3932(00)00072-5)
- Hartikainen, K. M., Ogawa, K. H., & Knight, R. T. (2010). Trees over forest: Unpleasant stimuli compete for attention with global features. *NeuroReport*, 21(5). <https://doi.org/10.1097/WNR.0b013e328336eeb3>
- Hartikainen, K. M., Ogawa, K. H., Soltani, M., & Knight, R. T. (2007). Emotionally arousing stimuli compete for attention with left hemisphere. *NeuroReport*, 18(18), 1929–1933. <https://doi.org/10.1097/WNR.0b013e3282f1ca18>
- Hartikainen, K. M., Siiskonen, A. R., & Ogawa, K. H. (2012). Threat interferes with response inhibition. *NeuroReport*, 23(7), 447–450. <https://doi.org/10.1097/WNR.0b013e3283531e74>
- Hartikainen, K., Pihlaja, M., & Kolonen, M. (2021). Aivojen hyvinvointi ja toiminnanohjaus työelämässä. *Työterveyslääkäri*, 3, 58–60. https://digiplus.fi/www/Tyoterveyslaakari/2021_No3/page_58.html
- Hartikainen, K., Pihlaja, M., Räisänen, S., Bordi, L., Saariluoma, P., Päätalo, K., & Kolonen, M. (2021). Työuupumus – onko aivot unohdettu? *Sosiaalilääketieteellinen Aikakauslehti*, 58(1). <https://doi.org/10.23990/SA.102208>
- Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010a). Social Relationships and Mortality Risk: A Meta-analytic Review. *PLOS Medicine*, 7(7), e1000316. <https://doi.org/10.1371/JOURNAL.PMED.1000316>
- Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010b). Social relationships and mortality risk: a meta-analytic review. *PLoS Medicine*, 7(7). <https://doi.org/10.1371/JOURNAL.PMED.1000316>
- Kansallinen ikäohjelma vuoteen 2030 : Tavoitteena ikävyvykäs Suomi - Valto. (2020). Sosiaali- Ja Terveysministeriön Julkaisuja. <https://julkaisut.valtioneuvosto.fi/handle/10024/162462>
- Kekkonen, M., Gissler, M., Känkänen, P., Isola, A.M., T. (2022). Poikkeuksellinen nuoruus korona-aikaan Nuorten elinolot -vuosikirja 2022. <http://urn.fi/URN:ISBN:978-952-343-937-5> Konsensus 2020: Aivot ja Mieli - terveyden ja hyvinvoinnin edistäminen. (2020).

- Kulmala, J., Ngandu, T., Havulinna, S., Levälähti, E., Lehtisalo, J., Solomon, A., Antikainen, R., Laatikainen, T., Pippola, P., Peltonen, M., Rauramaa, R., Soininen, H., Strandberg, T., Tuomilehto, J., & Kivipelto, M. (2019). The Effect of Multidomain Lifestyle Intervention on Daily Functioning in Older People. *Journal of the American Geriatrics Society*, 67(6), 1138–1144. <https://doi.org/10.1111/JGS.15837>
- Liimatainen, J., Peräkylä, J., Järvelä, K., Sisto, T., Yli-Hankala, A., & Hartikainen, K. M. (2016). Improved cognitive flexibility after aortic valve replacement surgery. *Interactive Cardiovascular and Thoracic Surgery*, 23(4). <https://doi.org/10.1093/icvts/ivw170>
- Livingston, G., Huntley, J., Sommerlad, A., Ames, D., Ballard, C., Banerjee, S., Brayne, C., Burns, A., Cohen-Mansfield, J., Cooper, C., Costafreda, S. G., Dias, A., Fox, N., Gitlin, L. N., Howard, R., Kales, H. C., Kivimäki, M., Larson, E. B., Ogunniyi, A., ... Mukadam, N. (2020). Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet (London, England)*, 396(10248), 413–446. [https://doi.org/10.1016/S0140-6736\(20\)30367-6](https://doi.org/10.1016/S0140-6736(20)30367-6)
- Marengoni, A., Rizzuto, D., Fratiglioni, L., Antikainen, R., Laatikainen, T., Lehtisalo, J., Peltonen, M., Soininen, H., Strandberg, T., Tuomilehto, J., Kivipelto, M., & Ngandu, T. (2018). The Effect of a 2-Year Intervention Consisting of Diet, Physical Exercise, Cognitive Training, and Monitoring of Vascular Risk on Chronic Morbidity-the FINGER Randomized Controlled Trial. *Journal of the American Medical Directors Association*, 19(4), 355-360.e1. <https://doi.org/10.1016/J.JAMDA.2017.09.020>
- Martela, F., & Ryan, R. M. (2016). The Benefits of Benevolence: Basic Psychological Needs, Beneficence, and the Enhancement of Well-Being. *Journal of Personality*, 84(6), 750–764. <https://doi.org/10.1111/JOPY.12215>
- Miten Suomi voi? - Työterveyslaitos. (2022). <https://www.ttl.fi/tutkimus/hankkeet/miten-suomi-voi>
- Mobbs, D., Hagan, C. C., Dalgleish, T., Silston, B., & Prévost, C. (2015). The ecology of human fear: survival optimization and the nervous system. *Frontiers in Neuroscience*, 9(FEB), 55. <https://doi.org/10.3389/FNINS.2015.00055>
- Muistisairaudet – Käypä hoito -suositus. (2021). <https://www.kaypahoito.fi/hoi50044>
- Ngandu, T., Lehtisalo, J., Solomon, A., Levälähti, E., Ahtiluoto, S., Antikainen, R., Bäckman, L., Hänninen, T., Jula, A., Laatikainen, T., Lindström, J., Mangialasche, F., Pajajani, T., Pajala, S., Peltonen, M., Rauramaa, R., Stigsdotter-Neely, A., Strandberg, T., Tuomilehto, J., ... Kivipelto, M. (2015). A 2 year multidomain intervention of diet, exercise, cognitive training, and vascular risk monitoring versus control to prevent cognitive decline in at-risk elderly people (FINGER): a randomised controlled trial. *Lancet (London, England)*, 385(9984), 2255–2263. [https://doi.org/10.1016/S0140-6736\(15\)60461-5](https://doi.org/10.1016/S0140-6736(15)60461-5)
- Pohjonen, H. (2022, April 23). Aivotaloudellinen työtapa - pohjana hyvä peruskunto - NLY. <https://www.nly.fi/aivotaloudellinen-tyotapa-pohjana-hyva-peruskunto/>
- Poller, W. C., Downey, J., Mooslechner, A. A., Khan, N., Li, L., Chan, C. T., McAlpine, C. S., Xu, C., Kahles, F., He, S., Janssen, H., Mindur, J. E., Singh, S., Kiss, M. G., Alonso-Herranz, L., Iwamoto, Y., Kohler, R. H., Wong, L. P., Chetal, K., ... Swirski, F. K. (2022). Brain motor and fear circuits regulate leukocytes during acute stress. *Nature* 2022, 1–3. <https://doi.org/10.1038/s41586-022-04890-z>
- Roh, E., Song, D. K., & Kim, M. S. (2016). Emerging role of the brain in the homeostatic regulation of energy and glucose metabolism. *Experimental & Molecular Medicine* 2016 48:3, 48(3), e216–e216. <https://doi.org/10.1038/emm.2016.4>
- Ryan, R. M., & Deci, E. L. (2017). Self determination theory an introduction and overview. *Self-Determination Theory: Basic Psychological Needs in Motivation, Development, and Wellness*, 3–23. <https://www.adlibris.com/fi/kirja/self-determination-theory-9781462538966>
- Sachdev, P., Chen, X., & Wen, W. (2008). White matter hyperintensities in mid-adult life. *Current Opinion in Psychiatry*, 21(3), 268–274. <https://doi.org/10.1097/YCO.0B013E3282F945D5>

- Shen, C., Rolls, E., Cheng, W., Kang, J., Dong, G., Xie, C., Zhao, X.-M., Sahakian, B., & Feng, J. (2022). Associations of Social Isolation and Loneliness With Later Dementia. *Neurology*, 10.1212/WNL.0000000000200583. <https://doi.org/10.1212/WNL.0000000000200583>
- Skitsofrenia - Käypä hoito -suositus. (2022). <https://www.kaypahoito.fi/hoi35050>
- Sosiaali- ja terveystieteiden tutkimuskeskus. (2020). Kansallinen ikäohjelma vuoteen 2030.
- Strandberg, T. E., Levälähti, E., Ngandu, T., Solomon, A., Kivipelto, M., Kivipelto, M., Ngandu, T., Lehtisalo, J., Laatikainen, T., Soininen, H., Strandberg, T., Antikainen, R., Jula, A., Tuomilehto, J., Peltonen, M., Levälähti, E., Lindström, J., Rauramaa, R., Pajala, S., ... Mangialasche, F. (2017). Health-related quality of life in a multidomain intervention trial to prevent cognitive decline (FINGER). *European Geriatric Medicine*, 8(2), 164–167. <https://doi.org/10.1016/J.EURGER.2016.12.005>
- Sutin, A. R., Luchetti, M., Aschwanden, D., Stephan, Y., & Terracciano, A. (2021). Sense of purpose in life, cognitive function, and the phenomenology of autobiographical memory. *Memory (Hove, England)*, 29(9), 1126–1135. <https://doi.org/10.1080/09658211.2021.1966472>
- Tai, X. Y., Chen, C., Manohar, S., & Husain, M. (2022). Impact of sleep duration on executive function and brain structure. *Communications Biology* 2022 5:1, 5(1), 1–10. <https://doi.org/10.1038/s42003-022-03123-3>
- Työelämän yksinäisyys -barometri. (2022). HelsinkiMissio ry
- Unettomuus - Käypä hoito -suositus. (2020). <https://www.kaypahoito.fi/hoi50067>
- Uniapnea (obstruktiivinen uniapnea aikuisilla) - Käypä hoito -suositus. (2021). <https://www.kaypahoito.fi/hoi50088>
- Vorma, H., Rotko, T., Larivaara, M., & Kosloff, A. (2020). Kansallinen mielenterveysstrategia ja itsemurhien ehkäisyohjelma vuosille 2020–2030.
- Wiehler, A., Branzoli, F., Adanyeguh, I., Mochel, F., & Pessiglione, M. (2022). A neuro-metabolic account of why daylong cognitive work alters the control of economic decisions. *Current Biology*, 32(16), 3564–3575.e5. <https://doi.org/10.1016/j.cub.2022.07.010>
- Williamson, W., Lewandowski, A. J., Forkert, N. D., Griffanti, L., Okell, T. W., Betts, J., Boardman, H., Siepmann, T., McKean, D., Huckstep, O., Francis, J. M., Neubauer, S., Phellan, R., Jenkinson, M., Doherty, A., Dawes, H., Frangou, E., Malamateniou, C., Foster, C., & Leeson, P. (2018). Association of Cardiovascular Risk Factors With MRI Indices of Cerebrovascular Structure and Function and White Matter Hyperintensities in Young Adults. *JAMA*, 320(7), 665–673. <https://doi.org/10.1001/JAMA.2018.11498>
- Wilson, R. S., Krueger, K. R., Arnold, S. E., Schneider, J. A., Kelly, J. F., Barnes, L. L., Tang, Y., & Bennett, D. A. (2007). Loneliness and Risk of Alzheimer Disease. *Archives of General Psychiatry*, 64(2), 234–240. <https://doi.org/10.1001/ARCHPSYC.64.2.234>

Reports, programmes and surveys that have interfaces with the National Brain Health Programme

Hyvinvoinnin, terveyden ja turvallisuuden edistäminen 2030. Toimeenpanosuunnitelma. Valtioneuvosto Helsinki 2021. Valtioneuvoston julkaisuja 2021:27. Viitattu 22.9.2022.

Hyvinvoinnin, terveyden ja turvallisuuden edistäminen 2030. Toimeenpanosuunnitelma (valtioneuvosto.fi)

Kansallinen Ikäohjelma vuoteen 2030: Tavoitteena Ikäkyvykäs Suomi – Valto, 2020. Sosiaali- ja terveysministeriön julkaisuja 2020:31. Viitattu 22.9.2022.

Kansallinen ikäohjelma vuoteen 2030 (valtioneuvosto.fi)

Kansallisen lapsistrategian toimeenpanosuunnitelma. Valtioneuvoston periaatepäätös. Valtioneuvoston julkaisuja 2021:81. Viitattu 22.9.2022.

Kansallisen lapsistrategian toimeenpanosuunnitelma (valtioneuvosto.fi)

Konsensus 2020. Aivot ja mieli – terveyden ja hyvinvoinnin edistäminen. Lääkäriseura Duodecim ja Suomen Akatemia. Viitattu 22.9.2022.

Konsensuslausuma-1.7.pdf (duodecim.fi)

Liikkumisen suositukset. UKK-instituutti. 2022. Viitattu 22.9.2022

Liikkumisen suositukset - UKK-instituutti (ukkinstituutti.fi)

Mikä edistää aivoterveyttä? Tutkimustietoon perustuva selvitys. E2-tutkimus. 2022. Viitattu 22.9.2022.

e2_tutkimus_selvitys_0322.pdf (aivoliitto.fi)

Oikeus oppia- varhaiskasvatuksen ja perusopetuksen laadun ja tasa-arvon kehittämisohjelma Opetus- ja kulttuuriministeriö. Helsinki 2021. Viitattu 22.9.2022.

Oikeus oppia -kehittämisohjelma - OKM - Opetus- ja kulttuuriministeriö

Liikkuvat -kokonaisuus, Opetus- ja kulttuuriministeriö. Viitattu 22.9.2022

Liikunnallinen elämäntapa - OKM - Opetus- ja kulttuuriministeriö

Harrastamisen Suomen malli. Viitattu 22.9.2022

Suomen malli - OKM - Opetus- ja kulttuuriministeriö

FINGER-toimintamalli. 2022. Terveyden ja hyvinvoinnin laitos. Viitattu 22.9.2022

FINGER-toimintamalli - THL



National Brain Health Programme

Original Finnish version published on 23 November 2022.

Changes possible.

The most recent digital version of the document can be found at aivoliitto.fi/kansallinen-aivoterveysohjelma.

Photos: Mostphotos, Unsplash, Shutterstock

Illustrations: Salla Lehtipuu (2022)