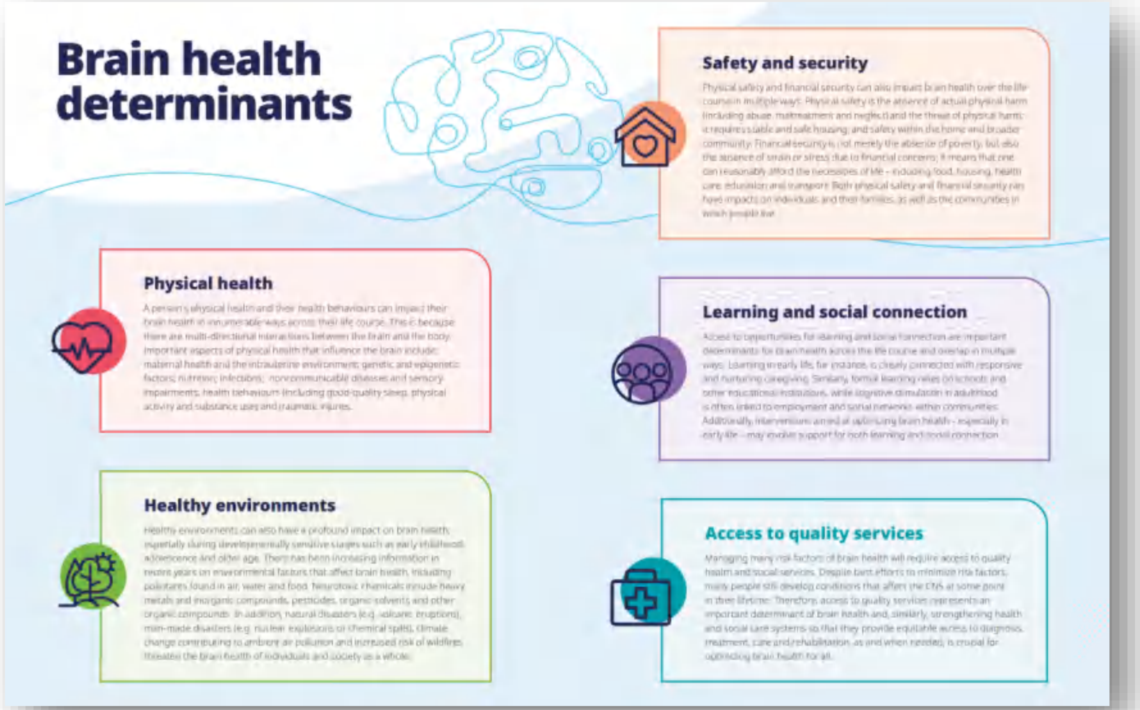


北京師範大學心理学部

Developmental Population Neuroscience

发展人口神经科学（个体脑健康与病史）

左西年 (Xi-Nian Zuo)

Beijing Normal University

State Key Lab of Cognitive Neuroscience & Learning

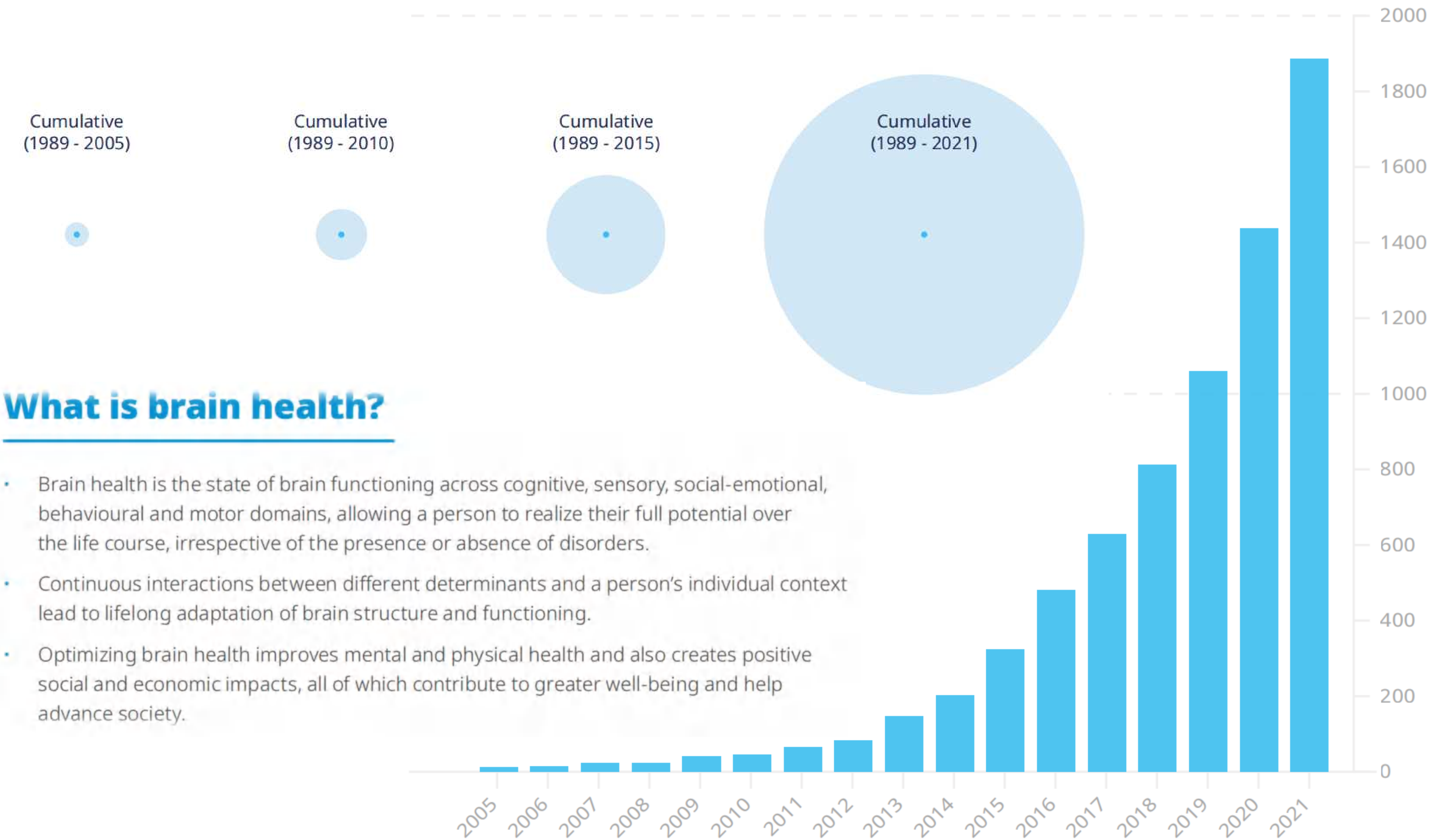
National Basic Science Data Center

Chinese Data-sharing Warehouse for In-vivo Imaging Brain

脑健康

Executive summary

> "Lack of brain health is often invisible; make it visible! Brain health affects us all. Not only the person with a brain condition but also their family, friends, colleagues, etc."
>
> **Anja Minheere, Netherlands**



What is brain health?

- Brain health is 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.
- Continuous interactions between different determinants and a person's individual context lead to lifelong adaptation of brain structure and functioning.
- Optimizing brain health improves mental and physical health and also creates positive social and economic impacts, all of which contribute to greater well-being and help advance society.

Why is Brain Health So Important?

Brain health is not only a crucial outcome in and of itself, but also an important mediator for other health and societal outcomes

43%

of children under the age of five in low- and middle-income countries were at risk of not reaching their developmental potential due to extreme poverty and stunting

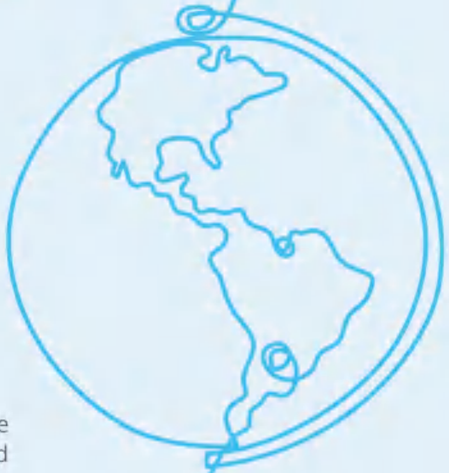
One in three people globally will develop a neurological disorder at some point in their lifetime

Key facts and figures on the global need for action on brain health

Worldwide, only 15 countries

report having three essential, family-friendly national policies that provide caregivers with resources and time needed for their child's development *(8)*.

1. **2 years** of tuition-free pre-primary school education.
2. **6 months** of paid breast-feeding breaks.
3. **6 months** of paid maternity leave and one month of paid paternity leave.



85 million children

under the age of 5 globally were not protected by any of these essential policies *(8)*.

Nearly 250 million children

in low- and middle-income countries risk not reaching their developmental potential due to extreme poverty and stunting *(6)*.

Missed developmental potential

due to poverty and stunting is projected to cause 26% lower annual earnings in adulthood *(7)*.

Growing environmental threats to brain health[1]

- Air pollution
- Heavy metals
- Certain pesticides
- Industrial solvents
- Other toxic chemicals

Over 200 chemicals are known to be neurotoxic.

Over 200 million people are exposed to arsenic in their ground water.

99% of the world breathes polluted air *(9)*.

Global burden associated with brain health

Neurological disorders are the #1 cause of DALYs, with the biggest contributors being stroke, migraine, dementia, meningitis and epilepsy *(10)*.

Neurological disorders are **the second leading cause of death** *(10)*.

Over 70% of people with neurological disorders reside in low- and middle-income countries

Yet, access to services is grossly insufficient.[2]

Only 1 in 10 people living with dementia in low-income countries receive a diagnosis.

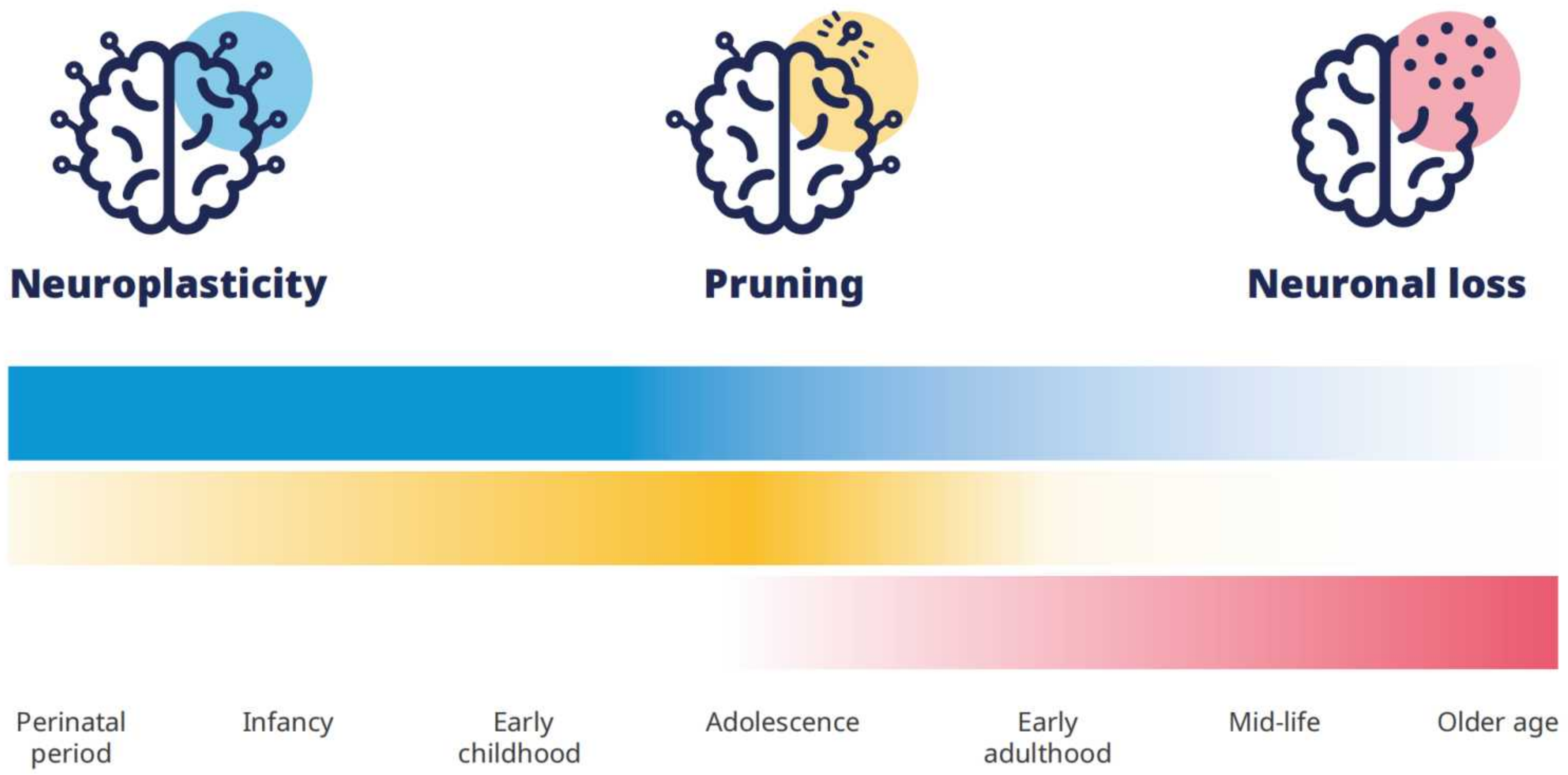
Only 1 in 4 people with epilepsy receive treatment.

Only 1 low-income country had warfarin available for stroke prevention compared with 73% of high-income countries.

Stroke units are operational in >90% of high-income countries, compared with only 18% of low- and middle-income countries.

Distribution of neurological workforce is grossly uneven. There is 7.1 neurological workforce/100K population in high-income countries vs 0.1/100K in low-income countries.

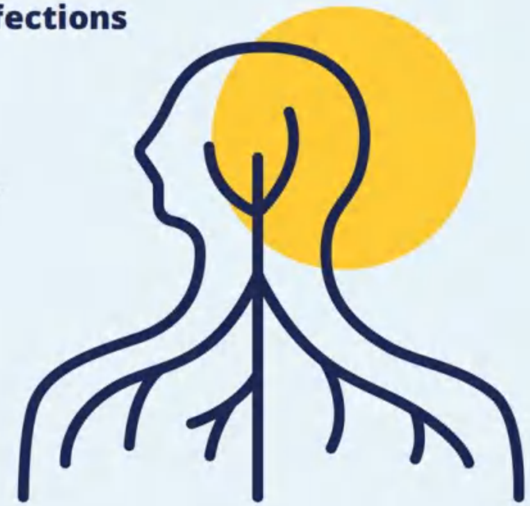
Stages of Brain Development across the Life Course



Disorders Affecting the Central Neural System

Common neurological conditions
- Dementia
- Epilepsy
- Headaches disorders
- Motor neuron disease
- Multiple sclerosis
- Parkinson disease
- Stroke

Neurological complications associated with infections
- Cysticercosis
- COVID-19
- Encephalitis
- Guillain-Barré syndrome
- HIV
- Malaria
- Meningitis
- Rabies
- Syphilis
- Tetanus
- Zika virus

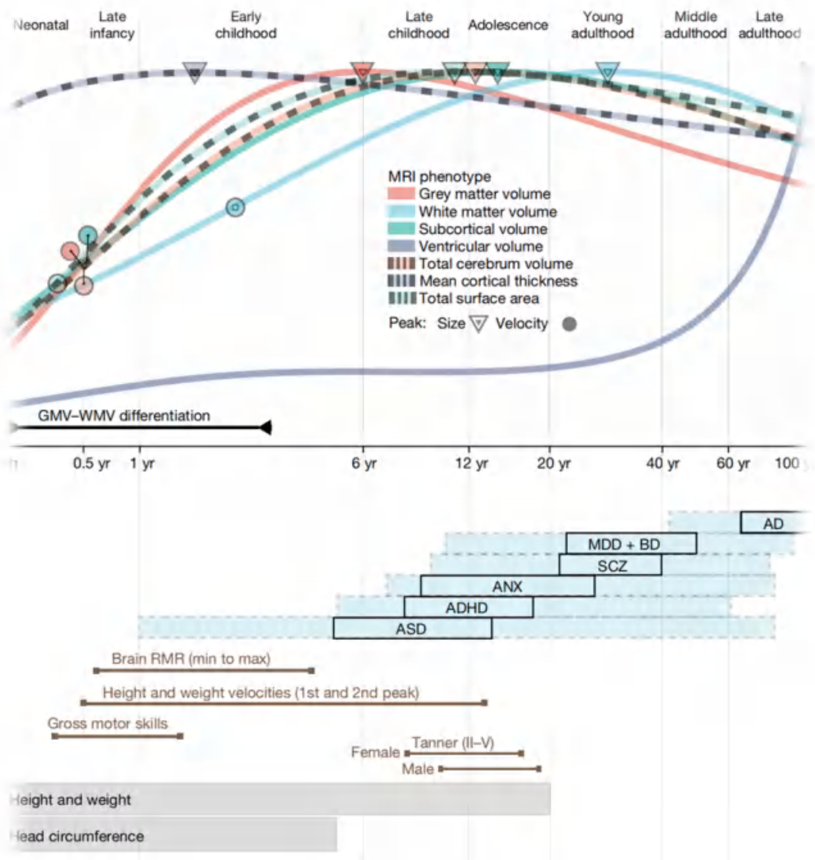


Injuries
- Spinal cord injury
- Traumatic brain injury

Tumours
- Tumours of the nervous system

Neurodevelopmental disorders
- Attention-deficit/hyperactivity disorder
- Autism spectrum disorders
- Cerebral palsy
- Fetal alcohol syndrome
- Idiopathic developmental intellectual disability

Congenital conditions
- Congenital birth defects
- Down syndrome
- Neural tube defects
- Other genetic defects



Brain health determinants

Safety and security

Physical safety and financial security can also impact brain health over the life course in multiple ways. Physical safety is the absence of actual physical harm (including abuse, maltreatment and neglect) and the threat of physical harm; it requires stable and safe housing, and safety within the home and broader community. Financial security is not merely the absence of poverty, but also the absence of strain or stress due to financial concerns; it means that one can reasonably afford the necessities of life – including food, housing, health care, education and transport. Both physical safety and financial security can have impacts on individuals and their families, as well as the communities in which people live.

Physical health

A person's physical health and their health behaviours can impact their brain health in innumerable ways across their life course. This is because there are multi-directional interactions between the brain and the body. Important aspects of physical health that influence the brain include: maternal health and the intrauterine environment; genetic and epigenetic factors; nutrition; infections; noncommunicable diseases and sensory impairments; health behaviours (including good-quality sleep, physical activity and substance use); and traumatic injuries.

Learning and social connection

Access to opportunities for learning and social connection are important determinants for brain health across the life course and overlap in multiple ways. Learning in early life, for instance, is closely connected with responsive and nurturing caregiving. Similarly, formal learning relies on schools and other educational institutions, while cognitive stimulation in adulthood is often linked to employment and social networks within communities. Additionally, interventions aimed at optimizing brain health – especially in early life – may involve support for both learning and social connection.

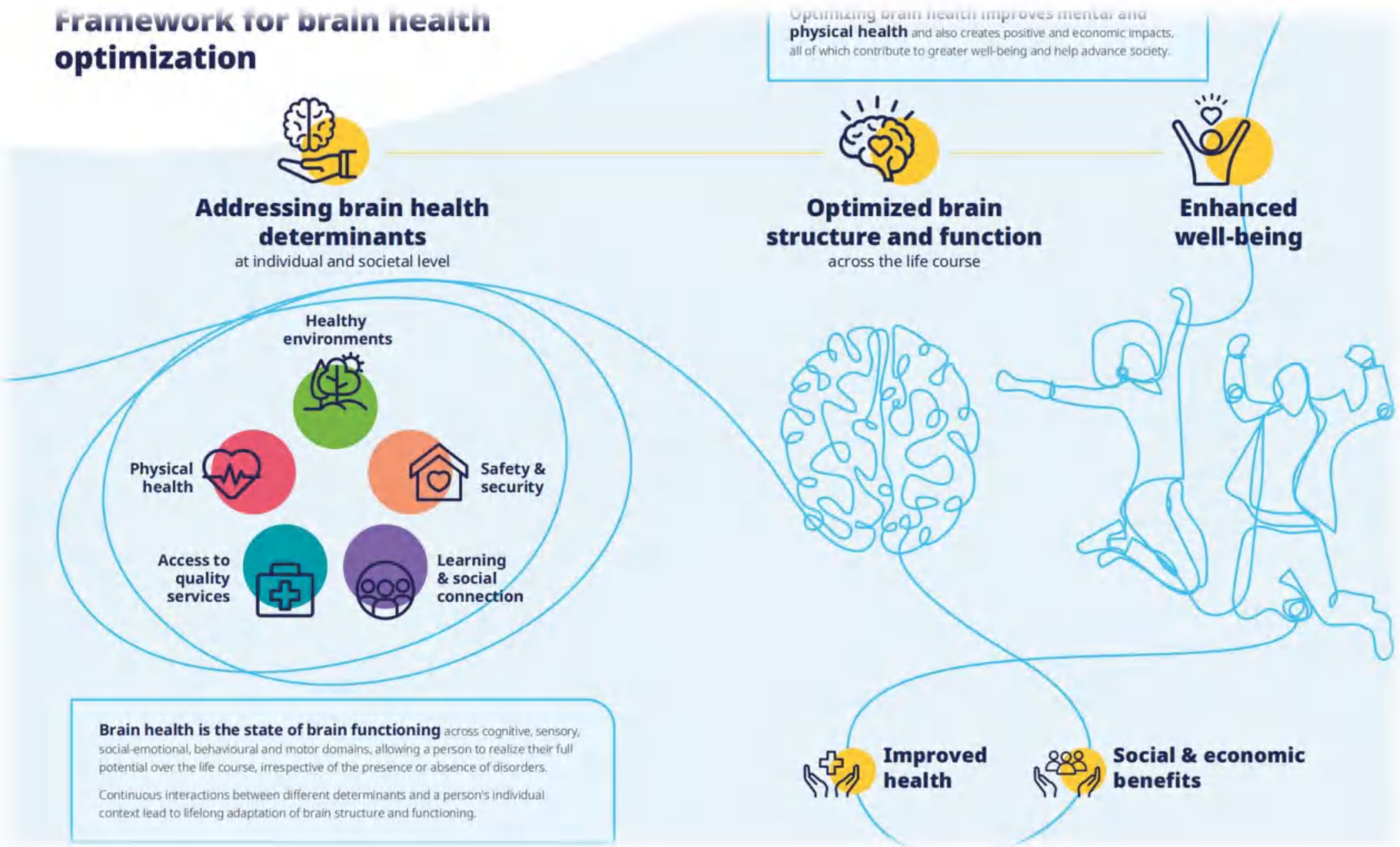
Healthy environments

Healthy environments can also have a profound impact on brain health, especially during developmentally sensitive stages such as early childhood, adolescence and older age. There has been increasing information in recent years on environmental factors that affect brain health, including pollutants found in air, water and food. Neurotoxic chemicals include heavy metals and inorganic compounds, pesticides, organic solvents and other organic compounds. In addition, natural disasters (e.g. volcanic eruptions), man-made disasters (e.g. nuclear explosions or chemical spills), climate change contributing to ambient air pollution and increased risk of wildfires threaten the brain health of individuals and society as a whole.

Access to quality services

Managing many risk factors of brain health will require access to quality health and social services. Despite best efforts to minimize risk factors, many people still develop conditions that affect the CNS at some point in their lifetime. Therefore, access to quality services represents an important determinant of brain health and, similarly, strengthening health and social care systems so that they provide equitable access to diagnosis, treatment, care and rehabilitation, as and when needed, is crucial for optimizing brain health for all.

What is Brain Health Optimization? How?



Optimizing brain health is paramount to ensuring that individuals can achieve their full potential

Determinants of Brain Health across the Life Course

A child's brain creates over 1 million new neuronal connections each second in the first few years of life

Physical health
Maternal health, intrauterine environment

Genetic and epigenetic factors

Nutrition

Infections

NCDs

Health behaviours

Traumatic injuries

Healthy environments
Safe use of chemicals

Protection from radiation

Healthy and safe workplaces and agricultural practices

Air and water quality

Stable climate

Access to preserved nature and health-supportive built environments

Safety & security
Physical safety

Financial security

Humanitarian crises and emergencies

Learning & social connection
Education

Lifelong learning

Nurturing care

Social connection/ social isolation

Social networks

Access to quality services
Integrated care at all health/social care levels

Skilled workforce and Interdisciplinary teams

Access to essential medicines, diagnostics and health products

Carer support

Addressing brain health determinants is a crucial element of brain health optimization

Determinant-I: Physical Health

Physical health

Maternal health, intrauterine environment

Genetic and epigenetic factors

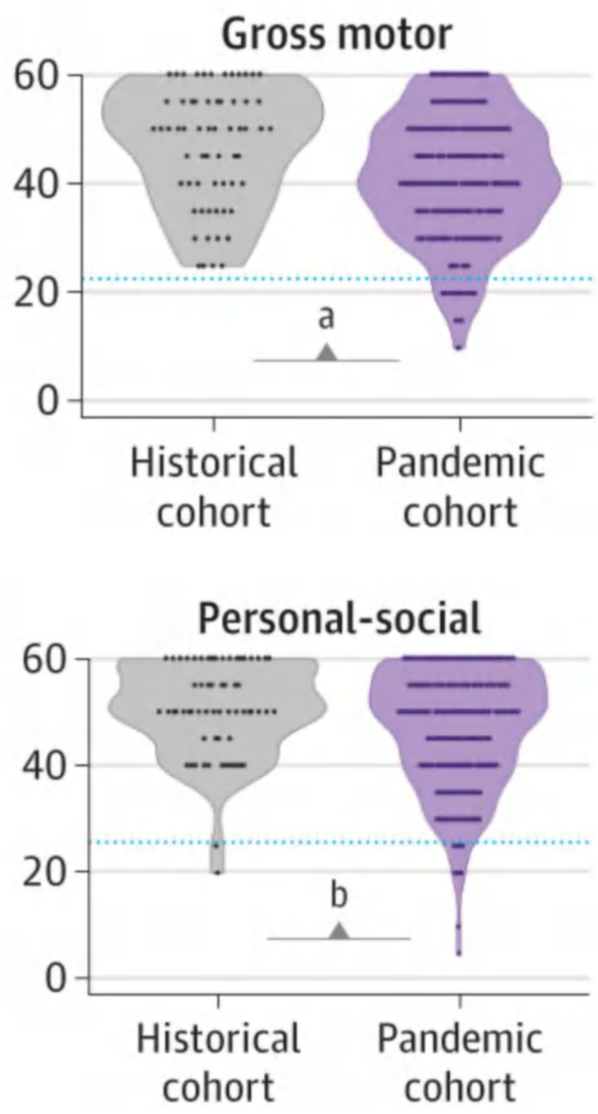
Nutrition

Infections

NCDs

Health behaviours

Traumatic injuries



JAMA Network Open

Original Investigation | Obstetrics and Gynecology

COVID-19 Pandemic and Infant Neurodevelopmental Impairment

A Systematic Review and Meta-analysis

Kamran Hessami, MD; Amir Hossein Norooznezhad, MD; Sonia Monteiro, MD; Enrico R. Barrozo, PhD; Abolfazl Shirdel Abdolmaleki, MD, MPH; Sara E. Arian, MD; Nikan Zargarzadeh, MD; Lara S. Shekerdemian, MD; Kjersti M. Aagaard, MD, PhD; Alireza A. Shamshirsaz, MD

RESULTS A total of 8 studies were included, including 21 419 infants (11 438 screened in pandemic and 9981 in prepandemic period). NDI was present in 330 of 8992 infants (7%; 95% CI, 4%-10%) screened during the COVID-19 pandemic from January 2020 to January 2021. Among the pandemic cohort, the prevalence of NDI among infants with gestational exposure to SARS-CoV-2 was 77 of 691 (12%; 95% CI, 6%-18%). Compared with the prepandemic cohort (2015-2019), the pandemic cohort was more likely to have communication impairment (OR, 1.70; 95% CI, 1.37-2.11; *P* < .001), without significant differences in other ASQ-3 domains (eg, gross motor, fine motor, personal-social, and problem-solving). In contrast, maternal SARS-CoV-2 infection was not associated with significant differences in any neurodevelopment domain in offspring, except for increasing the odds of fine motor impairment (OR, 3.46; 95% CI, 1.43-8.38; *P* < .001).

CONCLUSIONS AND RELEVANCE In this systematic review and meta-analysis examining the association between COVID-19 pandemic and the risk of NDI, findings suggest that overall neurodevelopment in the first year of life was not changed by either being born or raised during the SARS-CoV-2 pandemic or by gestational exposure to SARS-CoV-2. Interestingly, the first year of life during the COVID-19 pandemic, regardless of maternal infection, was significantly associated with the risk of communication delay among the offspring.

Determinant-I: Physical Health

Physical health

Maternal health, intrauterine environment

Genetic and epigenetic factors

Nutrition

Infections

NCDs

Health behaviours

Traumatic injuries


International Journal of Environmental Research and Public Health

MDPI

Article

Impact of the COVID-19 Pandemic on Loneliness and Social Isolation: A Multi-Country Study

Roger O'Sullivan, Annette Burns, Gerard Leavey, Iracema Leroi, Vanessa Burholt, James Lubben, Julianne Holt-Lunstad, Christina Victor, Brian Lawlor, Mireya Vilar-Compte, Carla M. Perissinotto, Mark A. Tully, Mary Pat Sullivan, Michael Rosato, Joanna McHugh Power, Elisa Tiilikainen and Thomas R. Prohaska

Correspondence: roger.osullivan@publichealth.ie

Abstract: The COVID-19 global pandemic and subsequent public health social measures have challenged our social and economic life, with increasing concerns around potentially rising levels of social isolation and loneliness. This paper is based on cross-sectional online survey data (available in 10 languages, from 2 June to 16 November 2020) with 20,398 respondents from 101 different countries. It aims to help increase our understanding of the global risk factors that are associated with social isolation and loneliness, irrespective of culture or country, to support evidence-based policy, services and public health interventions. We found the prevalence of severe loneliness was 21% during COVID-19 with 6% retrospectively reporting severe loneliness prior to the pandemic. A fifth were defined as isolated based on their usual connections, with 13% reporting a substantial increase in isolation during COVID-19. Personal finances and mental health were overarching and consistently cross-cutting predictors of loneliness and social isolation, both before and during the pandemic. With the likelihood of future waves of COVID-19 and related restrictions, it must be a public health priority to address the root causes of loneliness and social isolation and, in particular, address the needs of specific groups such as carers or those living alone.

Keywords: loneliness; social isolation; public health; COVID-19; risk factors

Variable (N Completed Item)	N (%)
Gender (n = 18,991)	
Females	14,917 (79%)
Age (n = 17,436)	Mean = 53 (SD 17.6)
Education (n = 18,056)	13,504 (75%)
Degree +	
Needs met by financial resources (n = 18,231)	
Very well	8046 (44%)
Fairly well	8456 (46%)
Poorly	1729 (10%)
Member of minority group (n = 18,353)	
Yes	1977 (11%)
Care provider (n = 19,046)	
Yes	5236 (27.5%)
Outcomes	N (%)
UCLA pre-COVID pandemic (n = 16,452)	
None/low (0–4)	13,204 (80%)
Moderate (5–6)	2314 (14%)
Severe (7+)	934 (6%)
UCLA during COVID pandemic (n = 16,343)	
None/low (0–4)	9277 (57%)
Moderate (5–6)	3659 (22%)
Severe (7+)	3407 (21%)
Lubben pre-COVID pandemic (n = 15,408)	
Isolated (<12)	3188 (21%)
Not isolated	12,220 (79%)
Lubben change during COVID pandemic (n = 15,322)	
Large increase in isolation (score < −2)	1989 (13%)
Small or no increase in isolation	13,333 (87%)

Determinant-I: Physical Health

Physical health

Maternal health, intrauterine environment

Genetic and epigenetic factors

Nutrition

Infections

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Traumatic injuries

Article

SARS-CoV-2 is associated with changes in brain structure in UK Biobank

https://doi.org/10.1038/s41586-022-04569-5

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Published online: 7 March 2022

Open access

Check for updates

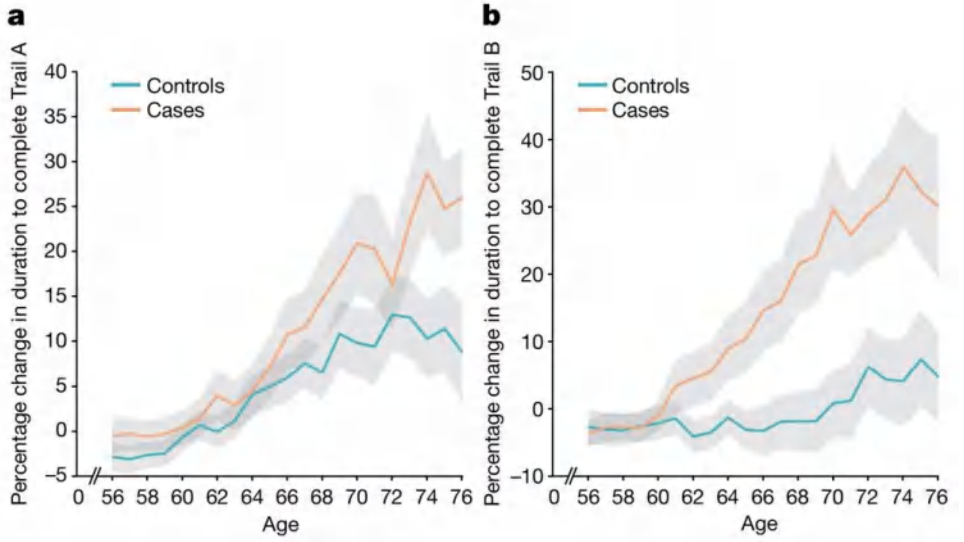
Gwenaëlle Douaud, Soojin Lee, Fidel Alfaro-Almagro, Christoph Arthofer, Chaoyue Wang, Paul McCarthy, Frederik Lange, Jesper L. R. Andersson, Ludovica Griffanti, Eugene Duff, Saad Jbabdi, Bernd Taschler, Peter Keating, Anderson M. Winkler, Rory Collins, Paul M. Matthews, Naomi Allen, Karla L. Miller, Thomas E. Nichols & Stephen M. Smith

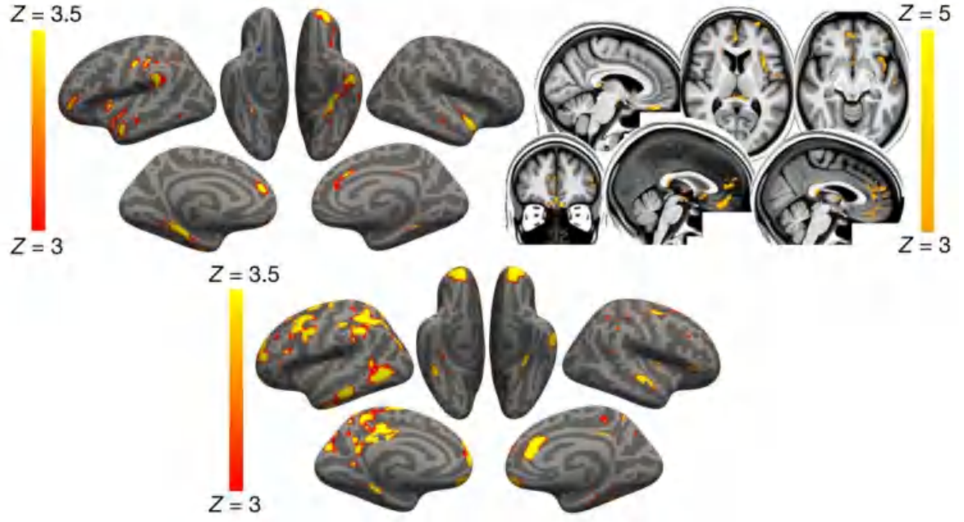
There is strong evidence of brain-related abnormalities in COVID-19. However, it remains unknown whether the impact of SARS-CoV-2 infection can be detected in milder cases, and whether this can reveal possible mechanisms contributing to brain pathology. Here we investigated brain changes in 785 participants of UK Biobank (aged 51–81 years) who were imaged twice using magnetic resonance imaging, including 401 cases who tested positive for infection with SARS-CoV-2 between their two scans—with 141 days on average separating their diagnosis and the second scan—as well as 384 controls. The availability of pre-infection imaging data reduces the likelihood of pre-existing risk factors being misinterpreted as disease effects. We identified significant longitudinal effects when comparing the two groups, including (1) a greater reduction in grey matter thickness and tissue contrast in the orbitofrontal cortex and parahippocampal gyrus; (2) greater changes in markers of tissue damage in regions that are functionally connected to the primary olfactory cortex; and (3) a greater reduction in global brain size in the SARS-CoV-2 cases. The participants who were infected with SARS-CoV-2 also showed on average a greater cognitive decline between the two time points. Importantly, these imaging and cognitive longitudinal effects were still observed after excluding the 15 patients who had been hospitalised. These mainly limbic brain imaging results may be the in vivo hallmarks of a degenerative spread of the disease through olfactory pathways, of neuroinflammatory events, or of the loss of sensory input due to anosmia. Whether this deleterious effect can be partially reversed, or whether these effects will persist in the long term, remains to be investigated with additional follow up.

The global pandemic of SARS-CoV-2 has now claimed millions of lives across the world. There has been an increased focus by the scientific and medical community on the effects of mild-to-moderate COVID-19 in the longer term. There is strong evidence for brain-related pathologies, some of which could be a consequence of viral neurotropism or virus-induced neuroinflammation, including the following: neurological and cognitive deficits demonstrated by patients, with an incidence of neurological symptoms in more than 80% of the severe cases, radiological and post mortem tissue analyses demonstrating the impact of COVID-19 on the brain, and the possible presence of the coronavirus in the central nervous system.

In particular, one consistent clinical feature, which can appear before the onset of respiratory symptoms, is the disturbance in olfaction and gustation in patients with COVID-19. In a recent study, 100% of the patients in the subacute stage of the disease were displaying signs of gustatory impairment (hypogeusia), and 86% signs of either hyposmia or anosmia. Such loss of sensory olfactory inputs to the brain could lead to a loss of grey matter in olfactory-related brain regions. Olfactory cells—whether neuronal or supporting—concentrated in the olfactory epithelium are also particularly vulnerable to coronavirus invasion, and this seems to be also the case specifically with SARS-CoV-2. Within the olfactory system, direct neuronal connections from and to the olfactory bulb encompass regions of the piriform cortex (the primary olfactory cortex), parahippocampal gyrus, entorhinal cortex and orbitofrontal areas.

Most brain imaging studies of COVID-19 to date have focussed on acute cases and radiological reports of single cases or case series based on computed tomography (CT), positron emission tomography (PET) or magnetic resonance imaging (MRI) scans, revealing a broad array of gross cerebral abnormalities, including white matter hyperintensities, hypoperfusion and signs of ischaemic events spread throughout the brain, but found more consistently in the cerebrum. Of the few larger





Determinant-I: Physical Health

Physical health

Maternal health, intrauterine environment

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Health behaviours

Traumatic injuries

BMJ Open

Effects of reducing sedentary behaviour duration by increasing physical activity, on cognitive function, brain function and structure across the lifespan: a systematic review protocol

To cite: Pindus DM, Selzer-Ninomiya A, Nayak A, *et al.* Effects of reducing sedentary behaviour duration by increasing physical activity, on cognitive function, brain function and structure across the lifespan: a systematic review protocol. *BMJ Open* 2022;**12**:e046077. doi:10.1136/

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ A comprehensive synthesis of acute and chronic effects of reducing sedentary behaviour duration by increasing time spent in physical activity on cognitive functions, brain function and structure in apparently healthy adults and children.
- ⇒ A rigorous systematic review methodology follows the guidelines of the Preferred Reporting Items for Systematic Reviews and employs the Effective Public Health Practice Project quality assessment tool to evaluate the risk of bias.
- ⇒ The heterogeneity of cognitive outcomes is accounted for by a structured synthesis based on the cognitive typology according to the involvement of controlled processes.
- ⇒ The generalisability of study results is limited to healthy children and adults.

School-aged children and adolescents (4–17 years),[32] younger adults (18–44 years), middle-aged adults (45–64 years)[76 77] and older adults (≥65 years)[77] will be included. The definition of midlife was based on the cognitive decline on several measures of higher order cognitive functions (e.g., inductive reasoning, episodic memory) observed in mid 40s and early 40s,[77 78] and the definition of midlife adopted in cancer prevention literature.[76] Definition of older adulthood has been adopted to align with the transition to retirement, and accelerated cognitive decline compared with middle age.[77] Children younger than 4 years will not be included due to underdeveloped EFs,[79–81] consistent with studies of PA and cognition in children.[82 83]

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ORIGINAL ARTICLE

PSYCHOPHYSIOLOGY SPR WILEY

Brain network modularity predicts changes in cortical thickness in children involved in a physical activity intervention

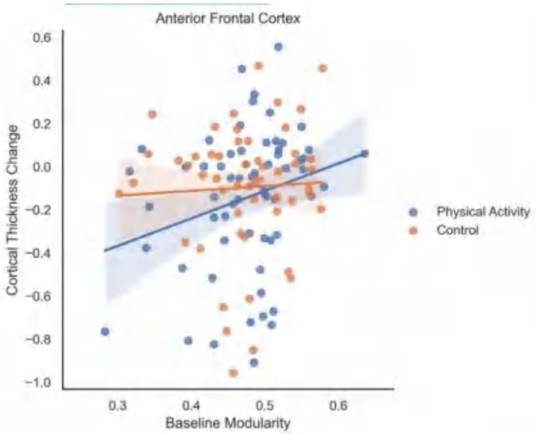


FIGURE 1 For children randomized to the 9-month after-school physical activity intervention, higher brain network modularity at baseline was positively associated with change in cortical thickness in the anterior frontal cortex. Brain network modularity at baseline did not positively predict changes in cortical thickness of the anterior frontal cortex in children in the wait-list control group. Change scores were computed as the difference in post-intervention and pre-intervention (or baseline) scores for each participant

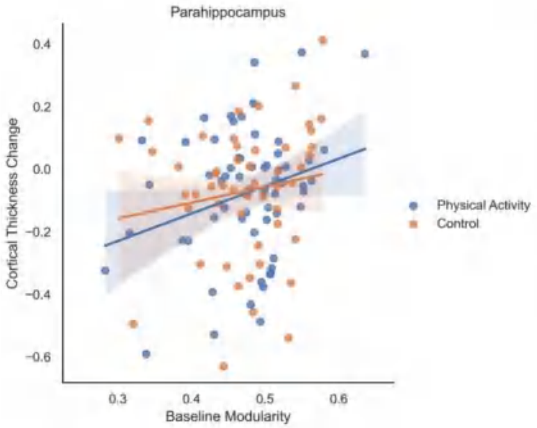
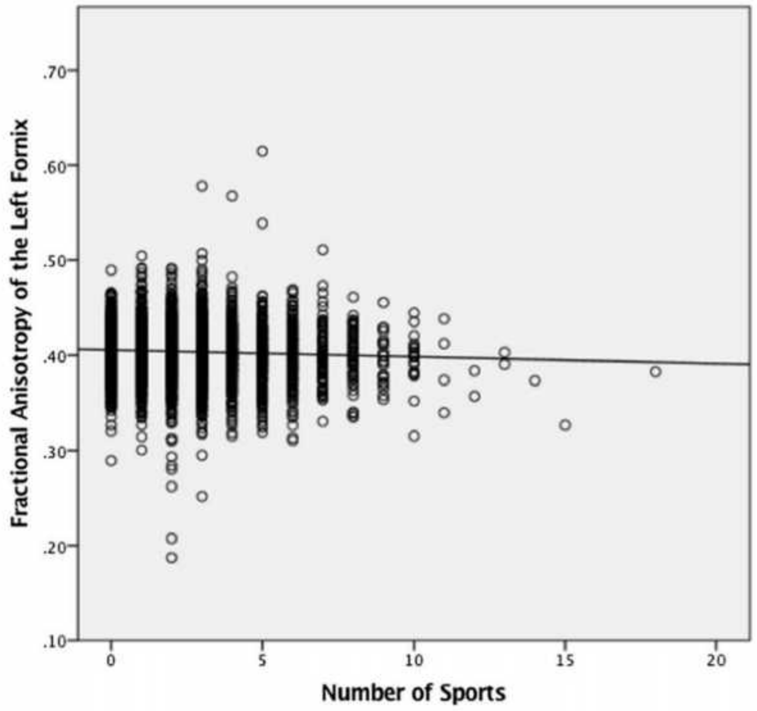


FIGURE 2 For children randomized to the 9-month after-school physical activity intervention, higher brain network modularity at baseline was positively associated with change in cortical thickness in the parahippocampus. Brain network modularity at baseline did not positively predict changes in cortical thickness of the parahippocampus in children in the wait-list control group. Change scores were computed as the difference in post-intervention and pre-intervention (or baseline) scores for each participant

Child Psychiatry & Human Development (2020) 51:490–501
https://doi.org/10.1007/s10578-020-00960-3

ORIGINAL ARTICLE

White Matter Tract Integrity, Involvement in Sports, and Depressive Symptoms in Children



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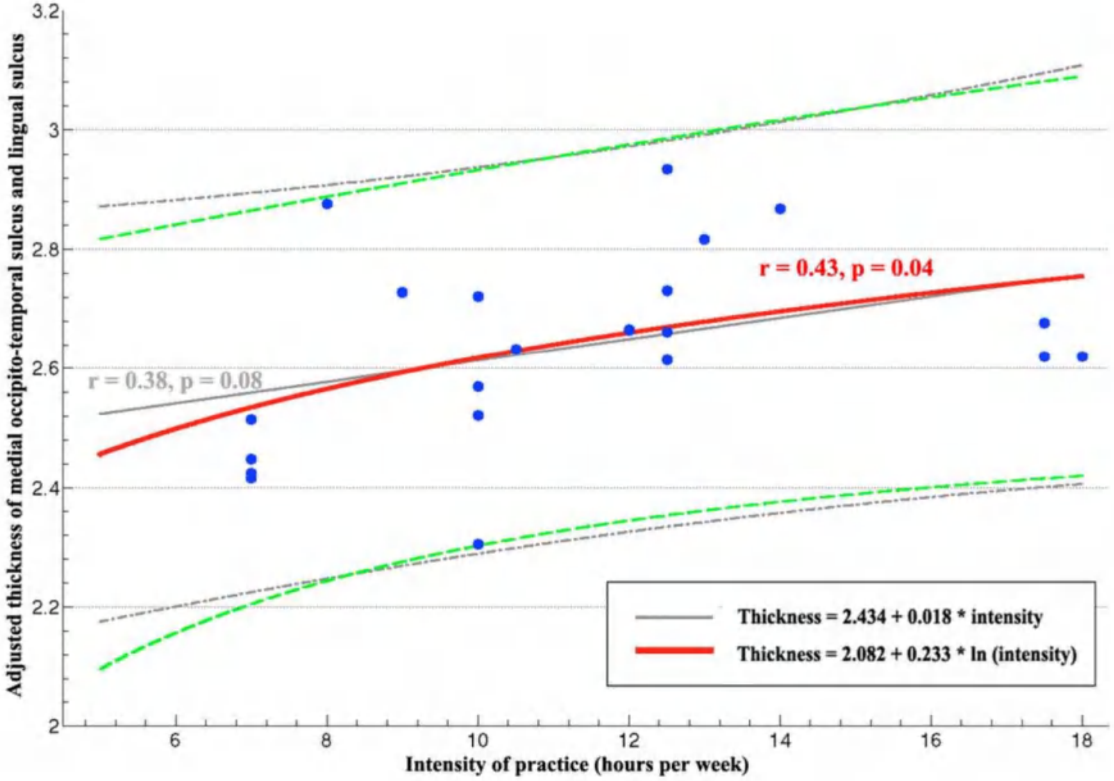
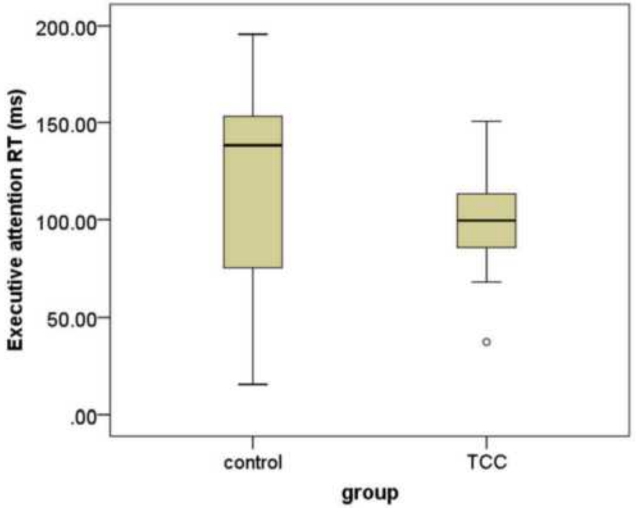
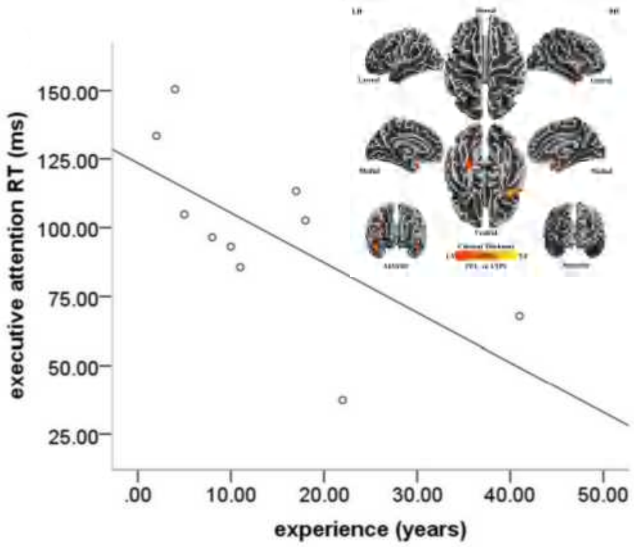
OPEN ACCESS Freely available online PLOS ONE

Can Taichi Reshape the Brain? A Brain Morphometry Study

Gao-Xia Wei[1,2], Ting Xu[1], Feng-Mei Fan[1,3], Hao-Ming Dong[1,5], Li-Li Jiang[1], Hui-Jie Li[1], Zhi Yang[1], Jing Luo[2,4]*, Xi-Nian Zuo[1]*







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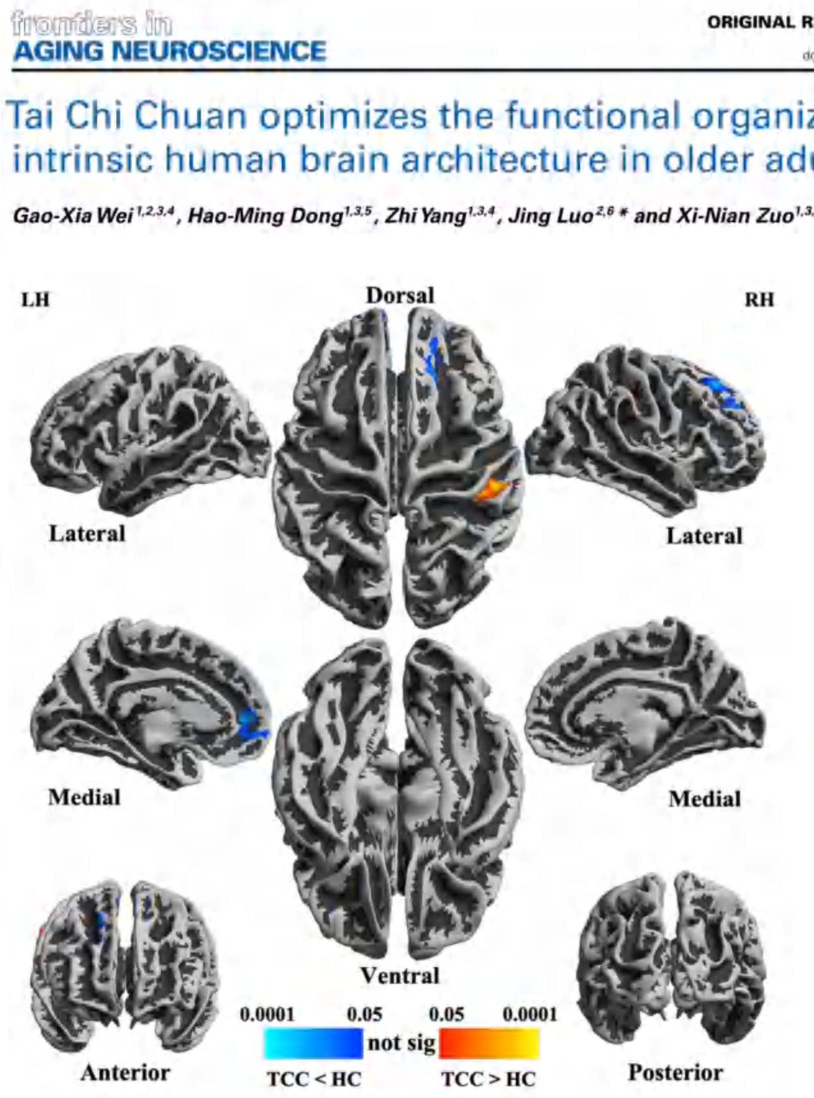

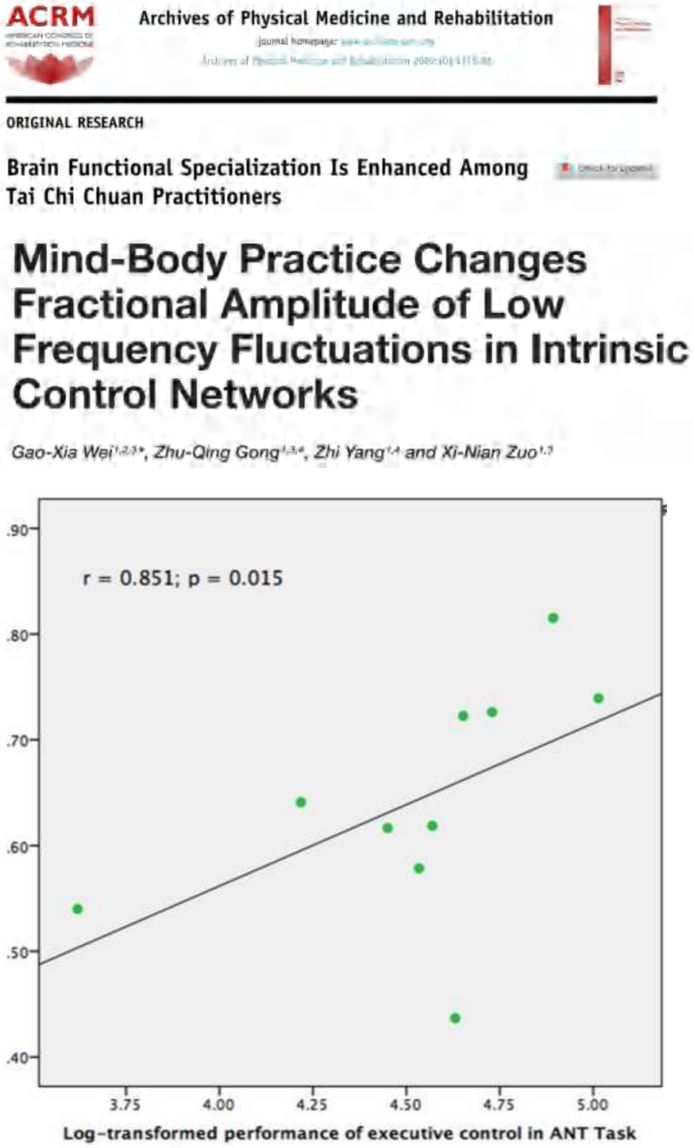

Physical health

Health and social care sector

- Increase access to perinatal, child and adolescent health care, including neurodevelopmental assessments.
- Improve access and appropriate use of essential medicines and diagnostics.
- Implement infectious disease management, eradication/control and immunization programmes.
- Run targeted prevention efforts to address obesity, hypertension, high cholesterol and diabetes.
- Improve post-accident emergency care and long-term rehabilitation.
- Promote tobacco cessation and reduction of harmful alcohol use, as well as physical activity and healthy diets.

Education

- Include growth monitoring and neurodevelopmental assessments in school health programmes.
- Design school curricula to teach children and adolescents about brain health promotion in an age-appropriate way.
- Implement healthy food programmes in schools.
- Include quality physical activity programmes in schools.
- Require helmet use for contact sports within schools to reduce the incidence of head injuries.

Finance and economy

- Dedicate a portion of the health budget to promoting brain health.
- Dedicate funding for school food and physical activity programmes.
- Introduce tobacco, alcohol and sugar taxation schemes.

Employment

- Promote physical activity and other healthy behaviours in the workplace, such as smoke-free workplaces.

Infrastructure, urban planning and housing

- Implement safety measures for roads and vehicles.
- Improve safety of home and community environments to reduce the risk of falls and traumatic brain injury, especially for older adults.
- Design cities to promote access to outdoor spaces for safe physical activity.
- Encourage urban planning and infrastructure development that improve access to outdoor spaces for safe physical activity and alternatives to a sedentary lifestyle.

Ecology, nature and climate

- Strengthen vector control for infectious diseases (e.g. Zika virus, malaria, taenia solium).
- Coordinate closely for the implementation of water, sanitation and hygiene actions to increase access to safe/clean drinking-water.

Determinant-II: Healthy Environment

Healthy environments

Safe use of chemicals

Protection from radiation

Healthy and safe workplaces and agricultural practices

Air and water quality

Stable climate

Access to preserved nature and health-supportive built environments

Erasmus MC
Universitair Medisch Centrum Rotterdam

Generation R

Generation R Next

HEI

Walter A. Rosenblith New Investigator Award

RESEARCH REPORT

HEALTH EFFECTS INSTITUTE

Number 209
February 2022

Associations of Air Pollution on the Brain in Children: A Brain Imaging Study

Mònica Guxens, Małgorzata J. Lubczyńska, Laura Pérez-Crespo, Ryan L. Muetzel, Hanan El Marroun, Xavier Basagaña, Gerard Hoek, Henning Tiemeier

Determinant-II: Healthy Environment

Healthy environments

Safe use of chemicals

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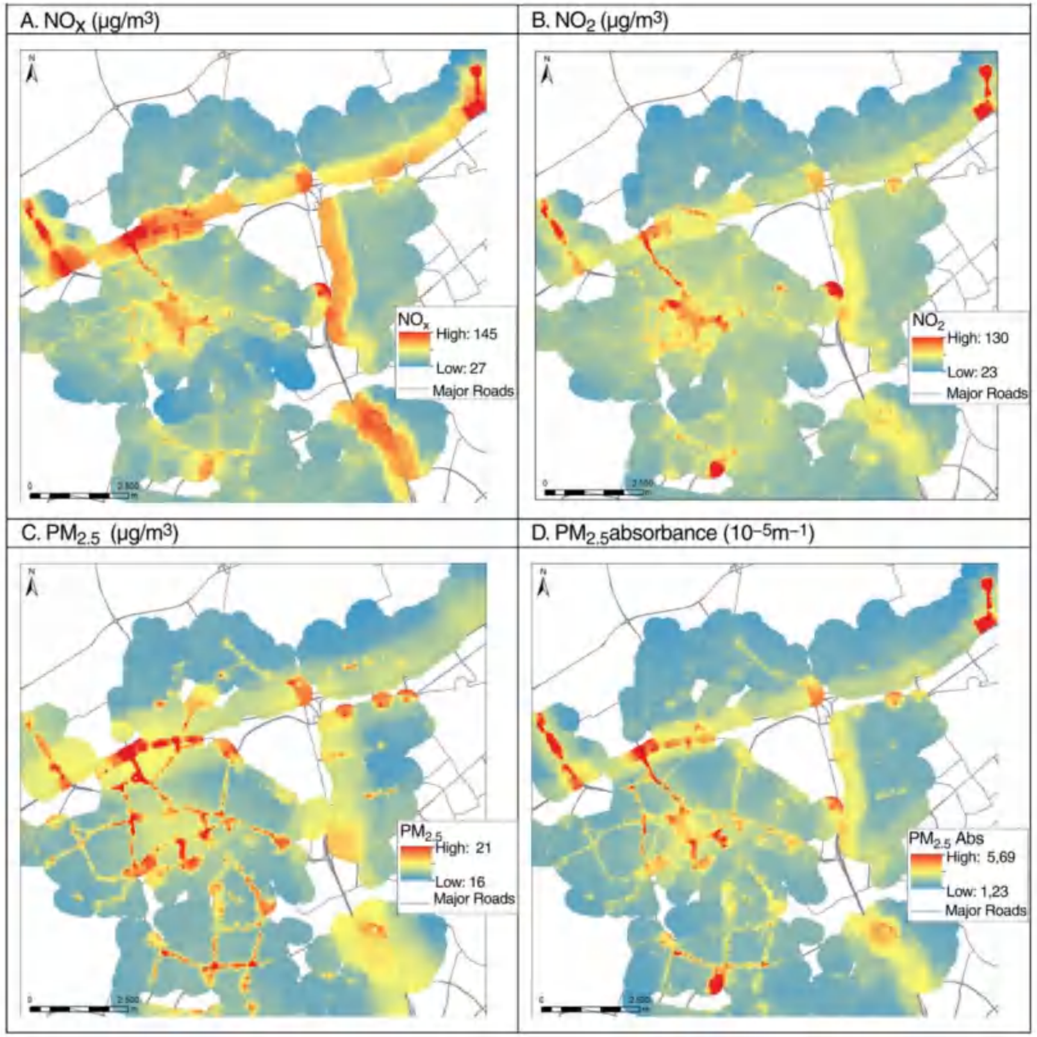


What This Study Adds

- The goal of the study was to assess whether early life air pollution exposure affects brain outcomes using neuroimaging data from an existing birth cohort (Generation R) in Rotterdam, the Netherlands.
- The study focused on brain structural and functional measures in children.
- Strengths of the study were the availability of high-resolution neuroimaging data for a large subset of the cohort, the wealth of individual-level covariate data, and estimation of a large suite of air pollution exposure metrics.
- The study found some evidence of associations between early life air pollution exposure and various measures of brain structural morphology, structural connectivity, and functional connectivity in children. For example, exposure to air pollution during early life was associated with a thinner cortex in various regions of the brain in both school-age children and pre-adolescents. The clinical relevance of the findings remains unclear.
- The results add to the limited evidence of air pollution effects on the developing brain, with only a few MRI studies in children so far.

Determinant-II: Healthy Environment

Healthy environments

Safe use of chemicals

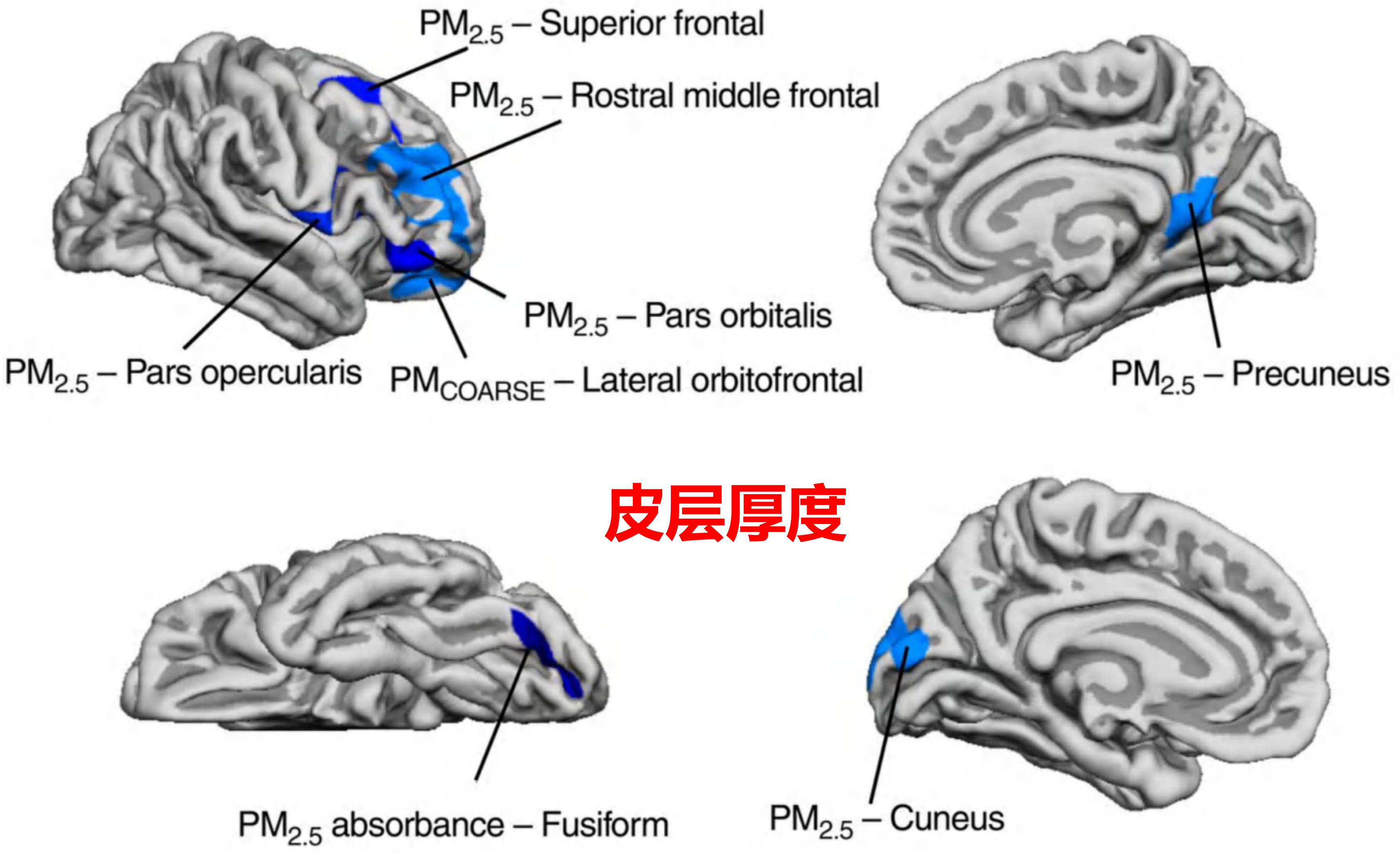
Protection from radiation

Healthy and safe workplaces and agricultural practices

Air and water quality

Stable climate

Access to preserved nature and health-supportive built environments



Determinant-II: Healthy Environment

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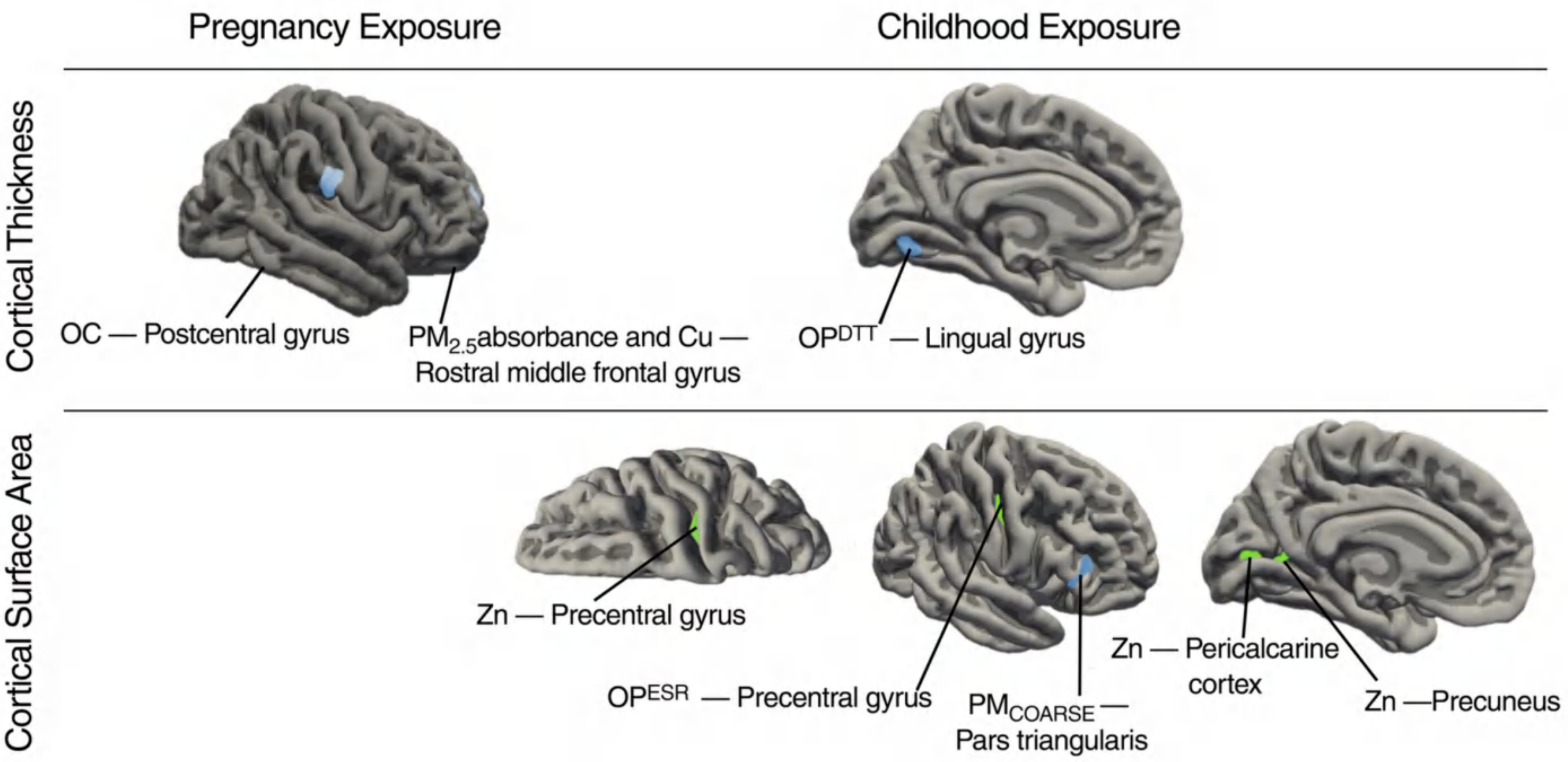

Determinant-II: Healthy Environment

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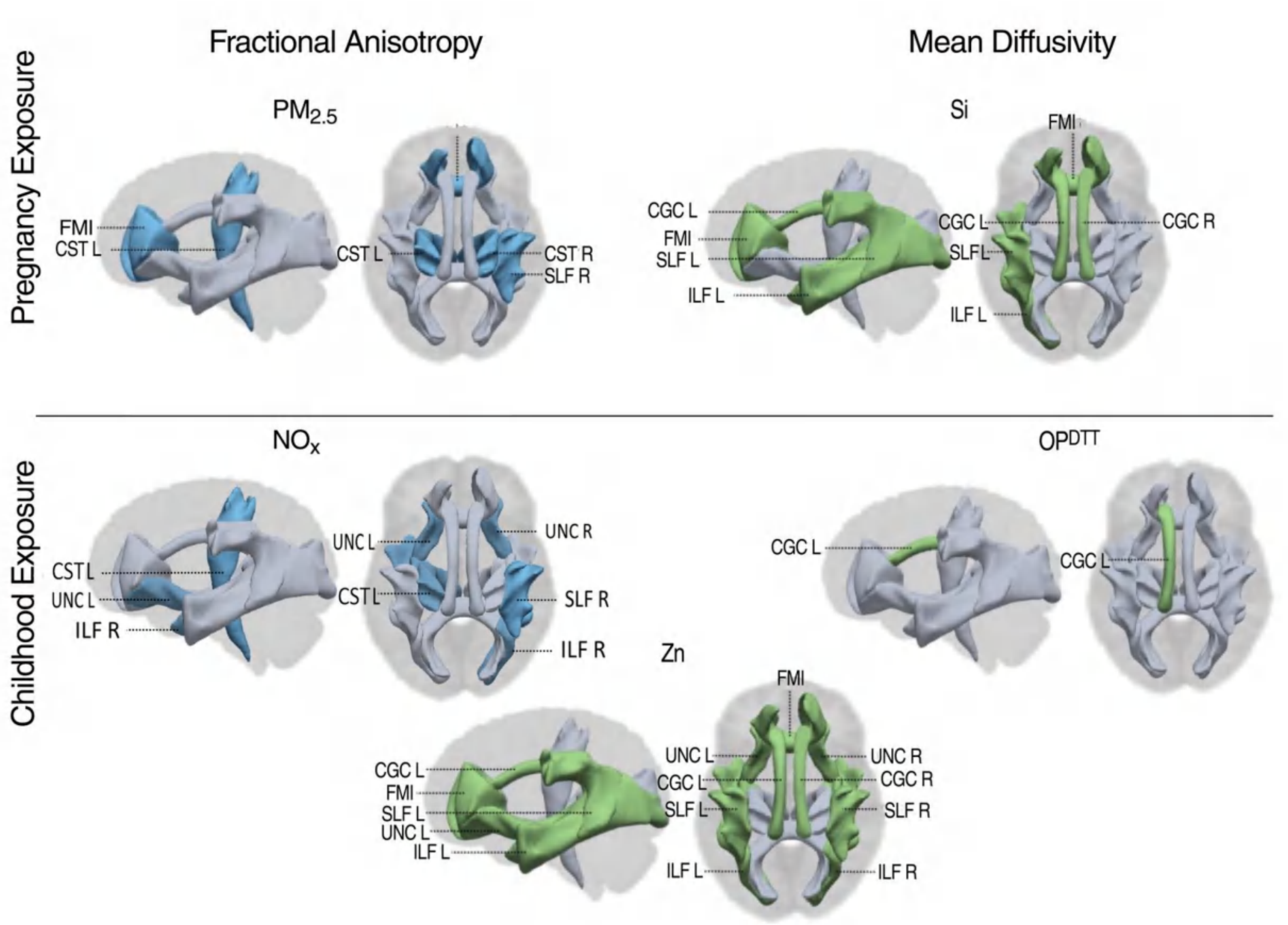
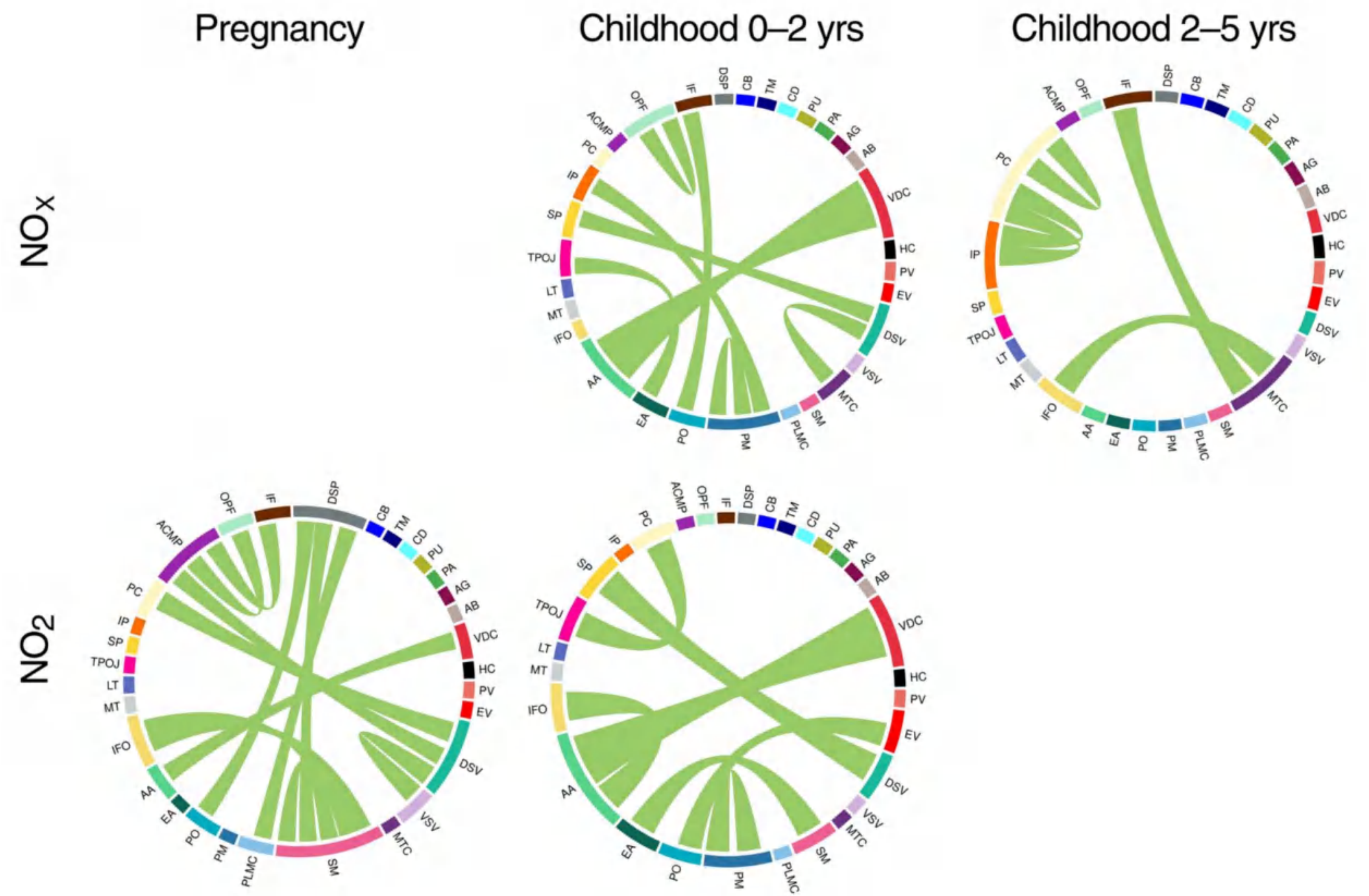


Determinant-II: Healthy Environment



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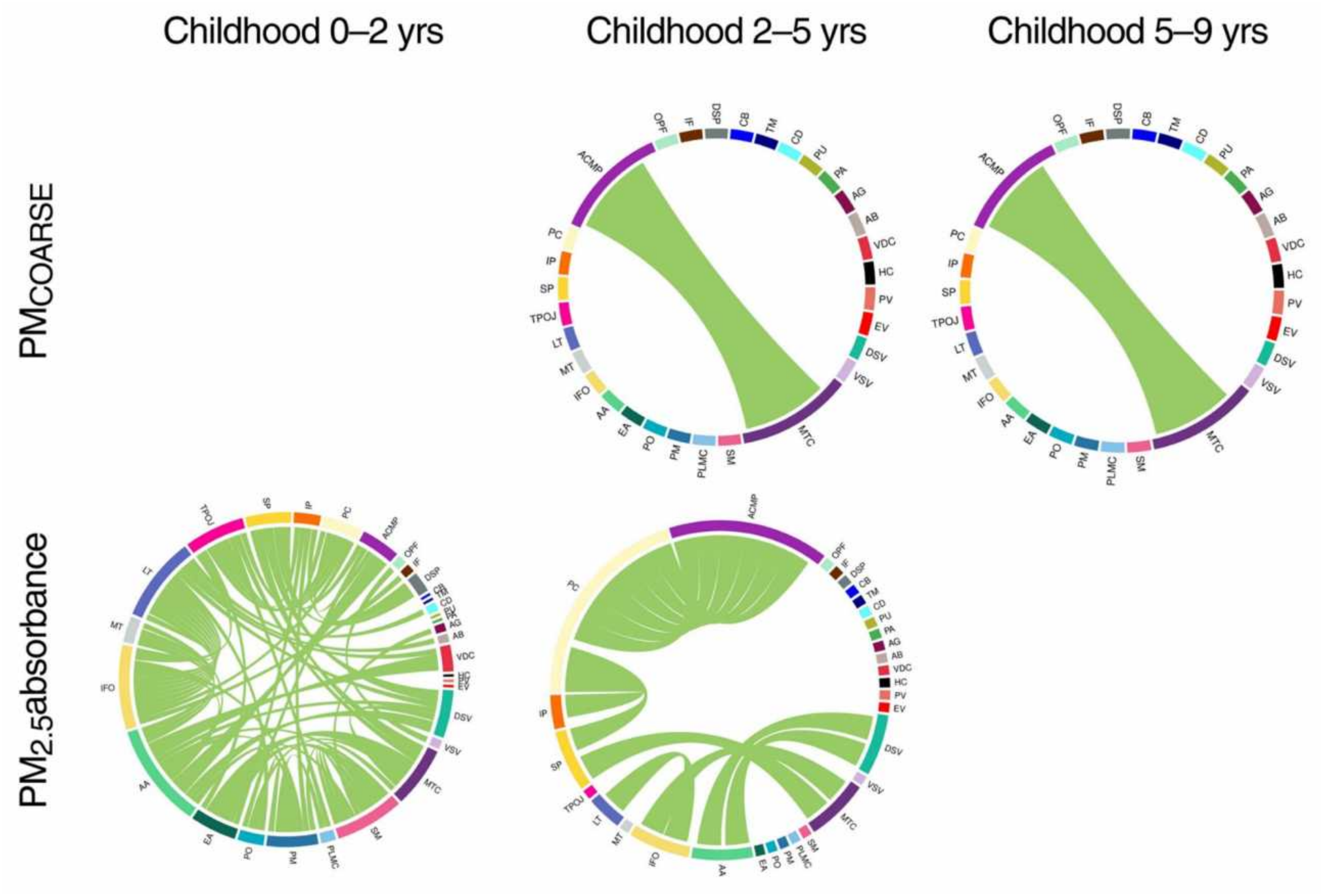

Healthy environments

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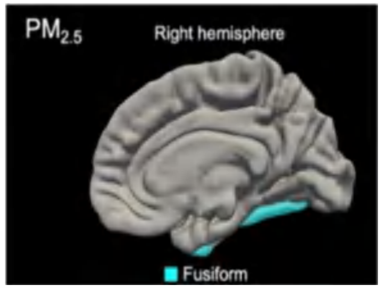
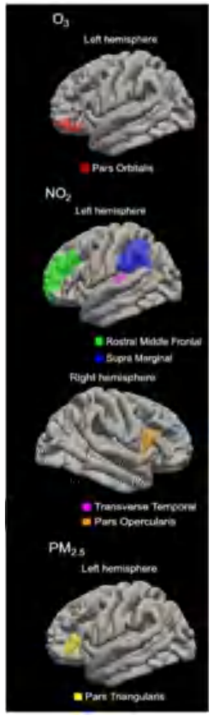
Determinant-II: Healthy Environment

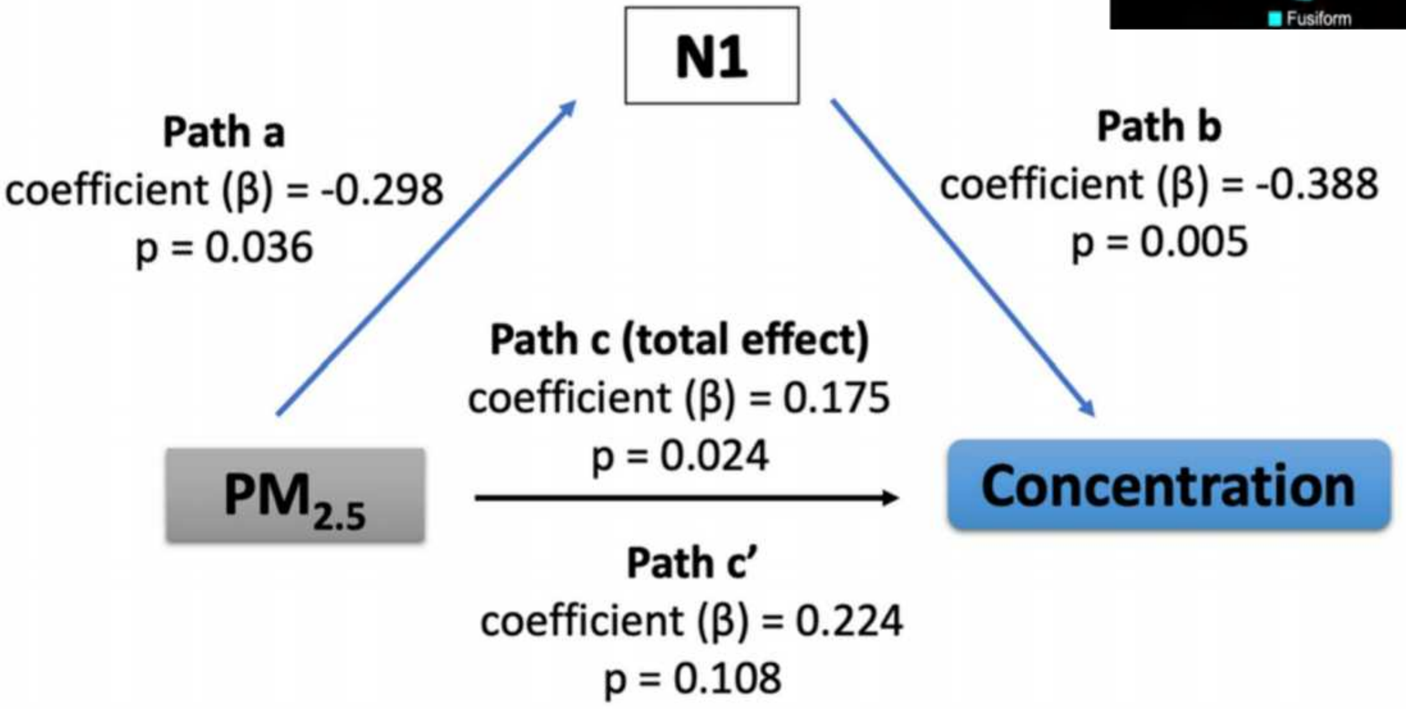
Environmental Science and Pollution Research (2022) 29:52355–52366
https://doi.org/10.1007/s11356-022-19482-7

RESEARCH ARTICLE



Air pollution associated with cognitive decline by the mediating effects of sleep cycle disruption and changes in brain structure in adults





Healthy environments

- Safe use of chemicals
- Protection from radiation
- Healthy and safe workplaces and agricultural practices
- Air and water quality
- Stable climate
- Access to preserved nature and health-supportive built environments

Determinant-II: Healthy Environment

RESEARCH ARTICLE

Association of Air Pollution and Physical Activity With Brain Volumes

Melissa A. Furlong, PhD, Gene E. Alexander, PhD, Yann C. Klimentidis, PhD, and David A. Raichlen, PhD

Neurology® 2022;98:e416-e426. doi:10.1212/WNL.0000000000013031

Abstract

Background and Objectives

In high-pollution areas, physical activity may have a paradoxical effect on brain health by increasing particulate deposition in the lungs. We examined whether physical activity modifies associations of air pollution (AP) with brain volumes in an epidemiologic framework.

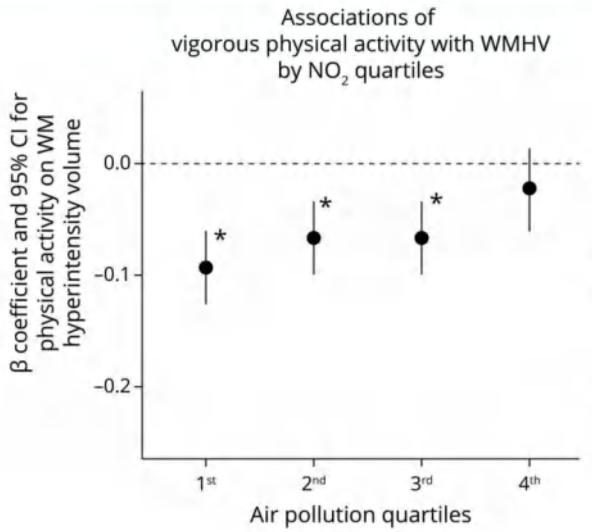
Methods

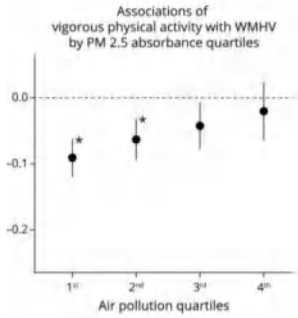
The UK Biobank enrolled >500,000 adult participants from 2006 to 2010. Wrist accelerometers, multimodal MRI with T1 images and T2 fluid-attenuated inversion recovery data, and land use regression were used to estimate vigorous physical activity (VigPA), structural brain volumes, and AP, respectively, in subsets of the full sample. We evaluated associations among AP interquartile ranges, VigPA, and brain structure volumes and assessed interactions between AP and VigPA.

Results

Eight thousand six hundred participants were included, with an average age of 55.55 (SD 7.46) years. After correction for multiple testing, in overall models, VigPA was positively associated with gray matter volume (GMV) and negatively associated with white matter hyperintensity volume (WMHV), while NO_2, $PM_{2.5absorbance}$, and $PM_{2.5}$ were negatively associated with GMV. NO_2 and $PM_{2.5absorbance}$ interacted with VigPA on WMHV (false discovery rate–corrected interaction $p = 0.037$). Associations between these air pollutants and WMHVs were stronger among participants with high VigPA. Similarly, VigPA was negatively associated with WMHV for those in areas of low NO_2 and $PM_{2.5absorbance}$ but was null among those living in areas of high NO_2 and $PM_{2.5absorbance}$.

Figure 1 Associations of VigPA With WMHV, by Air Pollution Quartiles





Healthy environments

Safe use of chemicals

Protection from radiation

Healthy and safe workplaces and agricultural practices

Air and water quality

Stable climate

Access to preserved nature and health-supportive built environments

Healthy environments

Health and social care sector

- Train health workers to recognize risks to brain health, signs and management of environmental toxicants.
- Implement testing of lead poisoning for infants and children.
- In partnership with humanitarian actors, strengthen emergency preparedness plans for natural and man-made disasters to ensure access to services for people with pre-existing or emergency-induced CNS disorders such as traumatic injuries.

Education

- Design school curricula to teach children and adolescents in an age-appropriate way about environmental impacts on brain health.

99%

of all people worldwide breathe polluted air in their ambient environment which threatens brain health across the life course

Finance and economy

- Dedicate a portion of the health budget to identifying and managing environmental risks to health.
- Dedicate funding for monitoring of environmental health-related legislation.

214

chemicals are recognized as neurotoxic to the human brain

Employment

- Invest in civil engineers, scientists, educational and health workers.
- Protect workers against/limit exposure to pesticides, heavy metals such as mercury, industrial solvents and other high-priority chemicals known to be neurotoxic.

Infrastructure, urban planning and housing

- Design new buildings to promote cleaner household and indoor air.
- Design cities to improve walkability and use of public transport versus personal vehicles.

Ecology, nature and climate

- Protect the population against/limit exposure to pesticides, heavy metals such as mercury, industrial solvents and other high-priority chemicals known to be neurotoxic.
- Monitor air and water quality with routine testing, make results publicly available and implement measures to improve air and water quality.
- Strengthen national capacity to prepare for, respond to, and recover after natural disasters, chemical spills and radiological and nuclear emergencies.

Determinant-III: Safety & Security

Safety & security

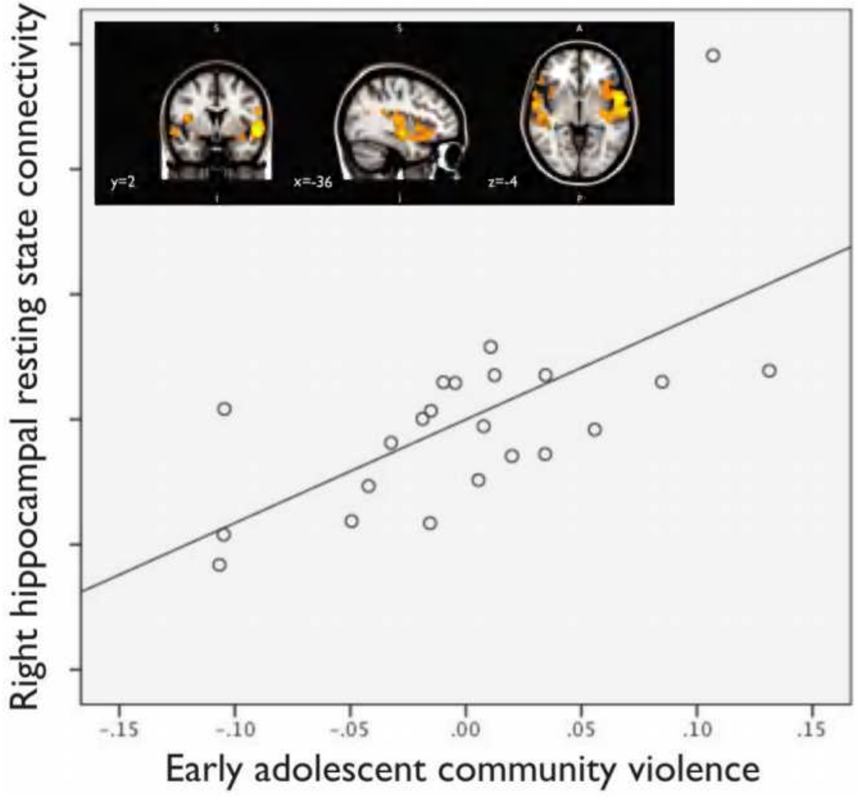
- Physical safety
- Financial security

Humanitarian crises and emergencies

PAPER

WILEY Developmental Science

Community violence exposure in early adolescence: Longitudinal associations with hippocampal and amygdala volume and resting state connectivity

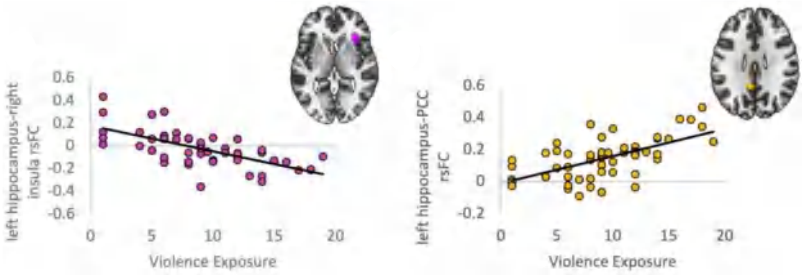


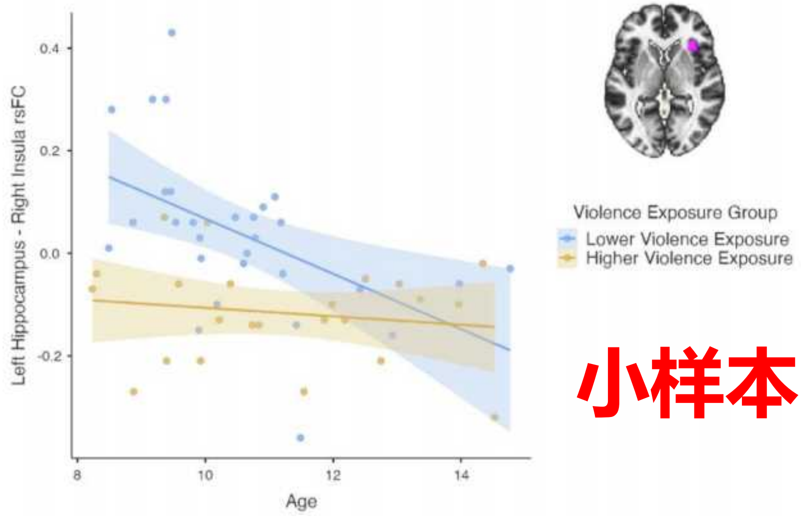
NEUROSCIENCE

RESEARCH ARTICLE

M. H. Reda et al. / Neuroscience 468 (2021) 149–157

Community Violence Exposure is Associated with Hippocampus–Insula Resting State Functional Connectivity in Urban Youth





小样本

Determinant-III: Safety & Security

Safety & security

Physical safety

Financial security

Humanitarian crises and emergencies

DOI: 10.1002/jts.22793

RESEARCH ARTICLE

ISTSS WILEY

Associations between potentially traumatic events and psychopathology among preadolescents in the Adolescent Brain and Cognitive Development Study®

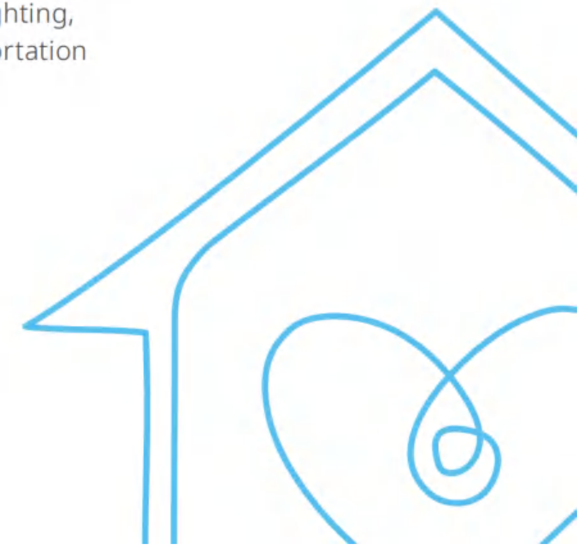
Full model[b]						
Accidents	1.11	[0.74, 1.66]	0.95	[0.68, 1.34]	1.03	[0.81, 1.33]
Natural disaster	1.17	[0.75, 1.84]	1.19	[0.81, 1.75]	1.22	[0.90, 1.65]
Death	1.03	[0.78, 1.36]	1.43**	[1.08, 1.66]	0.91	[0.76, 1.08]
Community violence	0.65	[0.26, 1.65]	1.04	[0.56, 1.94]	1.10	[0.66, 1.82]
Domestic violence	1.28	[0.85, 1.94]	1.22	[0.88, 1.73]	1.18	[0.91, 1.52]
Victimization	0.88	[0.42, 1.85]	1.18	[0.66, 2.12]	0.98	[0.62, 1.54]
Sexual trauma	0.83	[0.41, 1.69]	0.88	[0.49, 1.58]	1.17	[0.78, 1.75]
Polyvictimization	1.34	[0.79, 2.28]	1.01	[0.67, 1.52]	1.54**	[1.12, 2.12]
Caregiver mental health	1.01**	[1.00, 1.01]	1.01***	[1.00, 1.01]	1.01***	[1.01, 1.02]

Safety and security

Infrastructure, urban planning and housing

- Design communities and neighbourhoods to enhance physical safety (e.g. adequate lighting, frequent transportation stops).

Ecology, nature and climate



Health and social care sector

- Train health and social care workers to recognize signs of violence, abuse, maltreatment and neglect (especially of children, adolescents and older adults) and establish appropriate protective mechanisms.
- Streamline protection of brain health and neurological care within response plans for humanitarian crises.

Education

- Train education workers to identify cases of abuse, maltreatment and neglect in children and adolescents.

Legislature and governance

- Implement policies and programmes to:
  - prevent abuse/maltreatment/neglect of children, adolescents and older adults;
  - protect survivors of violence, including domestic/intimate partner violence; and
  - reduce violence at community level.
- Introduce social and financial protection schemes to increase financial security, prevent catastrophic health spending and prevent poverty.

Finance and economy

- Dedicate funding for housing protection programmes, as well as social and financial protection schemes.

Employment

- Abide by fair labour and minimum wages Acts and legislation.

Determinant-IV: Learning & Social Connection

Learning & social connection

Education

Lifelong learning

Nurturing care

Social connection/
social isolation

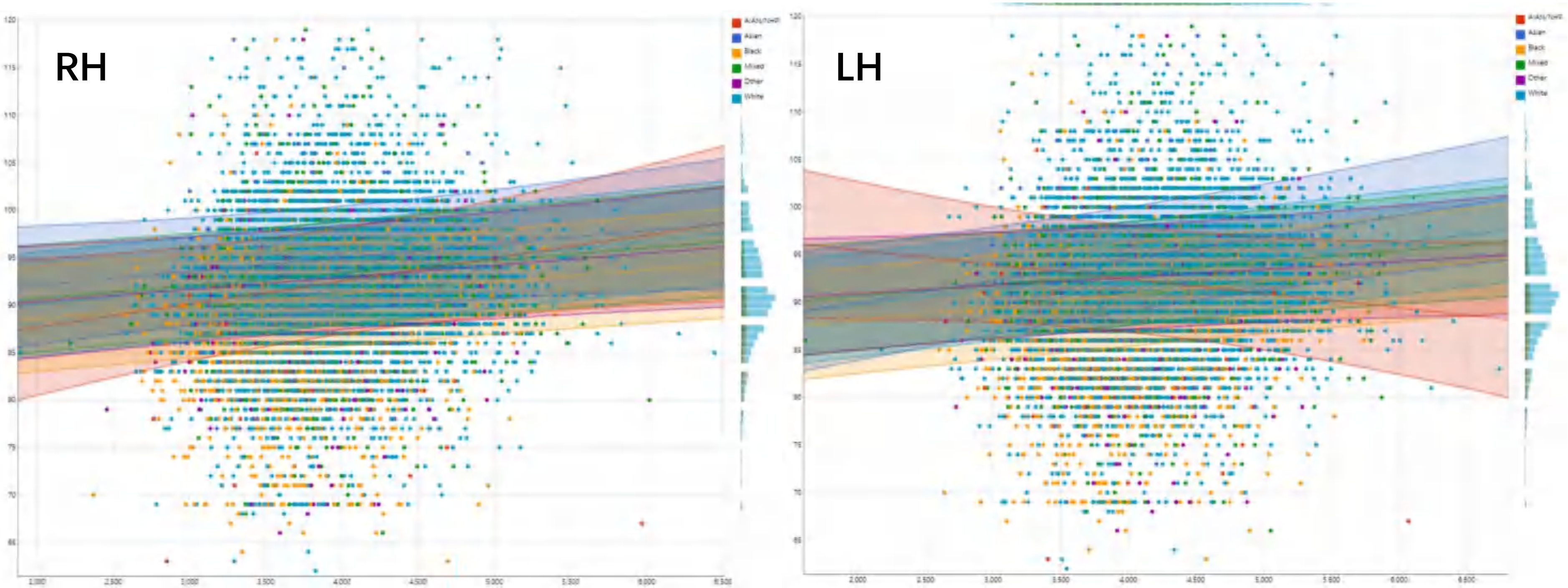
Social networks

children

MDPI

Article

Parental Educational Attainment, the Superior Temporal Cortical Surface Area, and Reading Ability among American Children: A Test of Marginalization-Related Diminished Returns



Determinant-IV: Learning & Social Connection

Learning & social connection

Education

Lifelong learning

Nurturing care

Social connection/ social isolation

Social networks

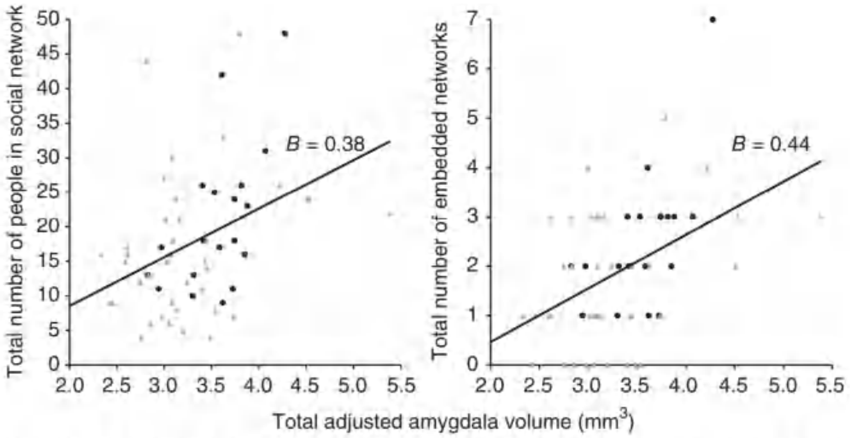
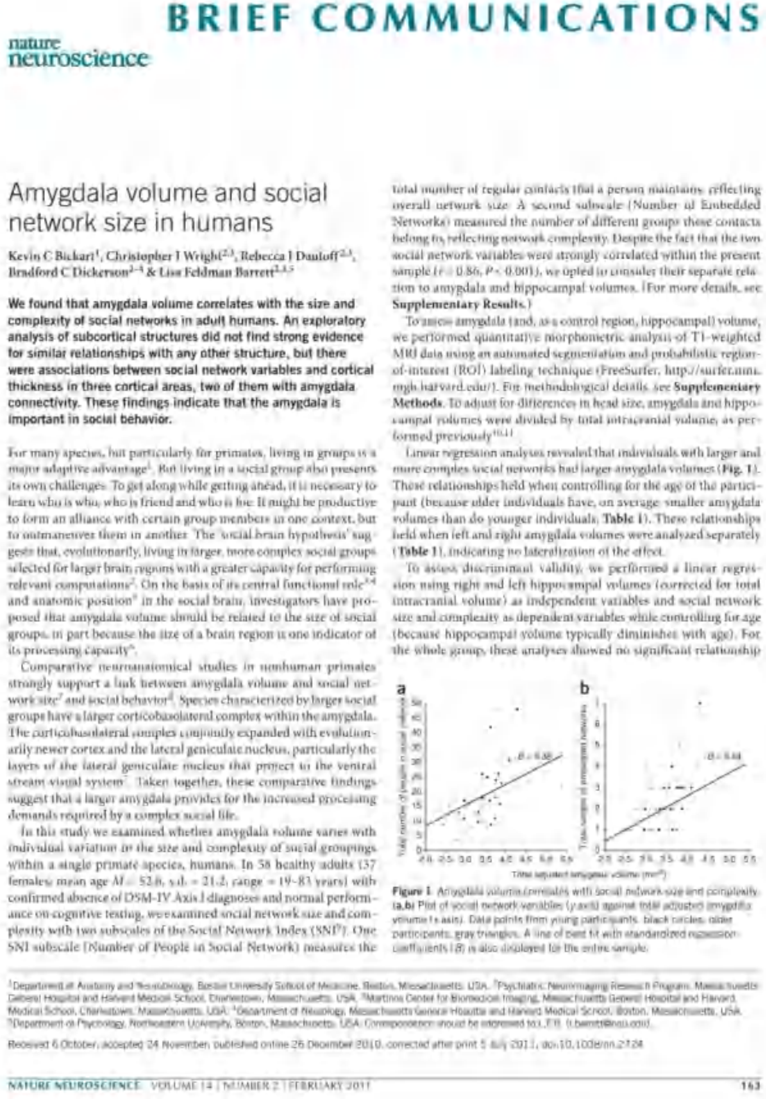


Figure 1 Amygdala volume correlates with social network size and complexity. (**a**,**b**) Plot of social network variables (*y* axis) against total adjusted amygdala volume (*x* axis). Data points from young participants, black circles; older participants, gray triangles. A line of best fit with standardized regression coefficients (*B*) is also displayed for the entire sample.

Table 1 Linear regressions using amygdala and hippocampal volumes as independent variables and social network characteristics as dependent variables

	Amygdala		Hippocampus	
	Left	Right	Left	Right
Whole group (n = 58)				
Social network size	**0.38, 2.84 (0.006)**	**0.29, 2.15 (0.036)**	0.23, 1.66 (0.103)	0.10, 0.72 (0.472)
Social network complexity	**0.39, 3.13 (0.003)**	**0.30, 2.32 (0.024)**	0.25, 1.89 (0.064)	0.15, 1.08 (0.286)
Young group (n = 19)				
Social network size	**0.58, 2.96 (0.009)**	**0.54, 2.61 (0.018)**	0.22, 0.94 (0.359)	–0.07, –0.27 (0.792)
Social network complexity	**0.56, 2.81 (0.012)**	**0.57, 2.85 (0.011)**	0.22, 0.94 (0.360)	–0.11, –0.45 (0.656)
Older group (n = 35)				
Social network size	**0.32, 2.05 (0.048)**	0.24, 1.52 (0.138)	0.27, 1.68 (0.102)	0.18, 1.11 (0.274)
Social network complexity	**0.38, 2.50 (0.017)**	0.28, 1.76 (0.086)	**0.32, 2.06 (0.047)**	0.27, 1.69 (0.099)
Females (n = 37)				
Social network size	0.30, 1.88 (0.069)	0.18, 1.05 (0.301)	0.19, 1.15 (0.258)	0.06, 0.35 (0.729)
Social network complexity	**0.43, 2.85 (0.007)**	0.27, 1.67 (0.105)	**0.36, 2.25 (0.031)**	0.23, 1.39 (0.174)
Males (n = 21)				
Social network size	**0.51, 2.60 (0.017)**	**0.62, 3.48 (0.002)**	0.18, 0.78 (0.448)	0.19, 0.85 (0.405)
Social network complexity	0.41, 1.98 (0.062)	**0.57, 2.99 (0.008)**	0.04, 0.18 (0.859)	0.09, 0.38 (0.708)



BRIEF COMMUNICATIONS
nature neuroscience

Amygdala volume and social network size in humans

Kevin C Bickart, Christopher I Wright, Rebecca J Dautoff, Bradford C Dickerson & Lisa Feldman Barrett

We found that amygdala volume correlates with the size and complexity of social networks in adult humans. An exploratory analysis of subcortical structures did not find strong evidence for similar relationships with any other structure, but there were associations between social network variables and cortical thickness in three cortical areas, two of them with amygdala connectivity. These findings indicate that the amygdala is important in social behavior.

Infrastructure, urban planning and housing

- Design cities, towns and communities to ensure easy access to school for children and adolescents, as well as access to workplaces, social and leisure activities for adults.

Ecology, nature and climate

Finance and economy

- Eliminate school fees.
- Introduce payment schemes for childcare and early childhood education programmes.

Learning and social connection

Health and social care sector

- Implement interventions for responsive caregiving and early learning.
- Train health and social care workers to identify loneliness and social isolation across the life course.

Education

- Increase access to early childhood learning programmes.
- Increase access to formal education and inclusive education.
- Implement interventions to promote adolescent brain health and development.
- Design school curricula to teach children and adolescents how to combat stigma, prejudice and discrimination in an age-appropriate way.

Legislature and governance

- Implement laws and legislation that:
  - mandate school attendance for primary and secondary school-age children;
  - prohibit child labour; and
  - aim to protect the rights of, and reduce stigma, prejudice and discrimination against, vulnerable populations, people with CNS conditions and their carers.

Employment

- Strengthen adequate monitoring to ensure that children are not used for labour.
- Promote lifelong learning in the workplace.

Determinant-V: Access to Quality Services

Access to quality services

Integrated care at all health/social care levels

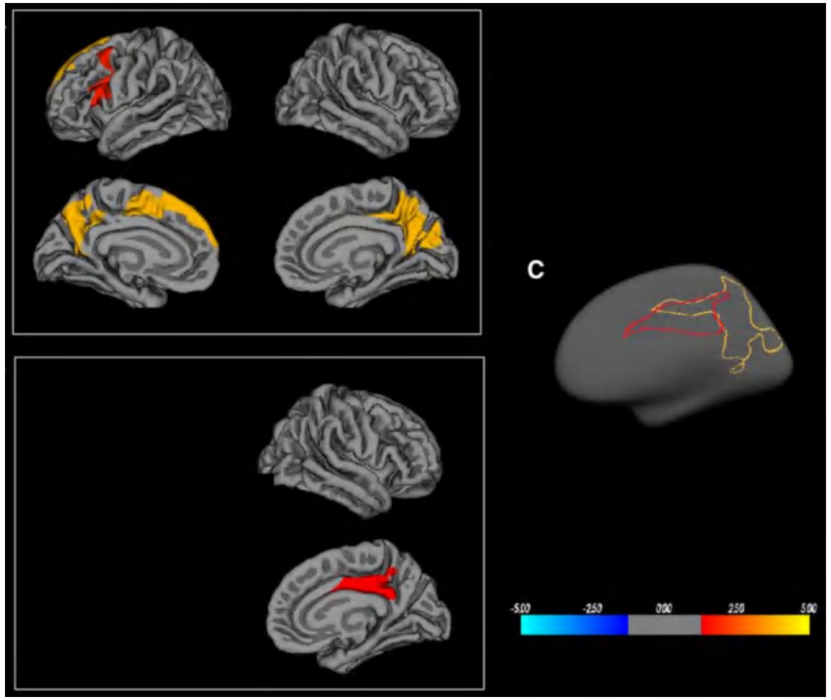
Skilled workforce and Interdisciplinary teams

Access to essential medicines, diagnostics and health products

Carer support

Qual Life Res (2017) 26:1209–1222
DOI 10.1007/s11136-016-1433-0

Proxy-reported quality of life in adolescents and adults with dyskinetic cerebral palsy is associated with executive functions and cortical thickness



Original Article

Hospital value-based purchasing, market competition, and outpatient imaging efficiency

Mei Zhao[1]^, Hanadi Y. Hamadi[1]^, D. Rob Haley[1]^, Kelly Pray[2], Paul A. Heyliger-Fonseca[3], Aaron Spaulding[4]^

Background: The Centers for Medicare & Medicaid Services (CMS) collects data on hospital outpatient imaging efficiency (OIE) to reduce unnecessary exposure to contrast materials and prevent wasteful use of Medicare resources. In 2013, CMS implemented the Inpatient Hospital Value-Based Purchasing Program to improve quality and efficiency. There has been no systematic study that examines the association between hospital inpatient hospital value-based purchasing (HVBP) total performance, market competition, and OIE. This study fills the gap in the literature.
Methods: Using a longitudinal study design, data from the 2015–2018 American Hospital Association Annual Survey, the Medicare Hospital Compare, and the Area Health Resources Files (AHRF) database were utilized. Statistical analyses were conducted using fixed effects multivariate linear panel regression model for all hospitals (n=4,093). The main outcome variables for this study were the six OIE variables measuring the efficient use of medical imaging tests, including magnetic resonance imaging (MRI) lumbar spine for low back pain, mammography follow-up rates, thorax computerized tomography use of contrast material, abdomen computerized tomography use of contrast material, cardiac imaging for preoperative risk assessment for non-cardiac low-risk surgery, and simultaneous use of brain computerized tomography and sinus computerized tomography. The main predictor variables were hospital inpatient total performance score (TPS) and hospital market concentration, defined by Herfindahl-Hirschman index (HHI).
Results: The multivariate panel data analysis indicated that hospitals with low TPSs also had a significantly lower rate of imaging services utilization for abdomen computerized tomography use of contrast material [coefficient (b) =−0.58; standard error (SE) =−0.22], indicating higher efficiency. also, hospitals in more competitive markets had a significantly higher rate of thorax computerized tomography use of contrast material (b=0.59; SE =−0.28), indicating lower efficiency of these services.
Conclusions: The findings from this study provide significant policy and practice implications. On the one hand, hospitals located in more competitive markets should consider strategies to improve their total performance to be better reimbursed by Medicare instead of offering more expensive outpatient imaging services. On the other hand, policymakers should monitor high performing hospitals since these hospitals also tend to provide more unnecessary outpatient imaging tests.

Determinant-V: Access to Quality Services

Access to quality services

Integrated care at all health/social care levels

Skilled workforce and Interdisciplinary teams

Access to essential medicines, diagnostics and health products

Carer support

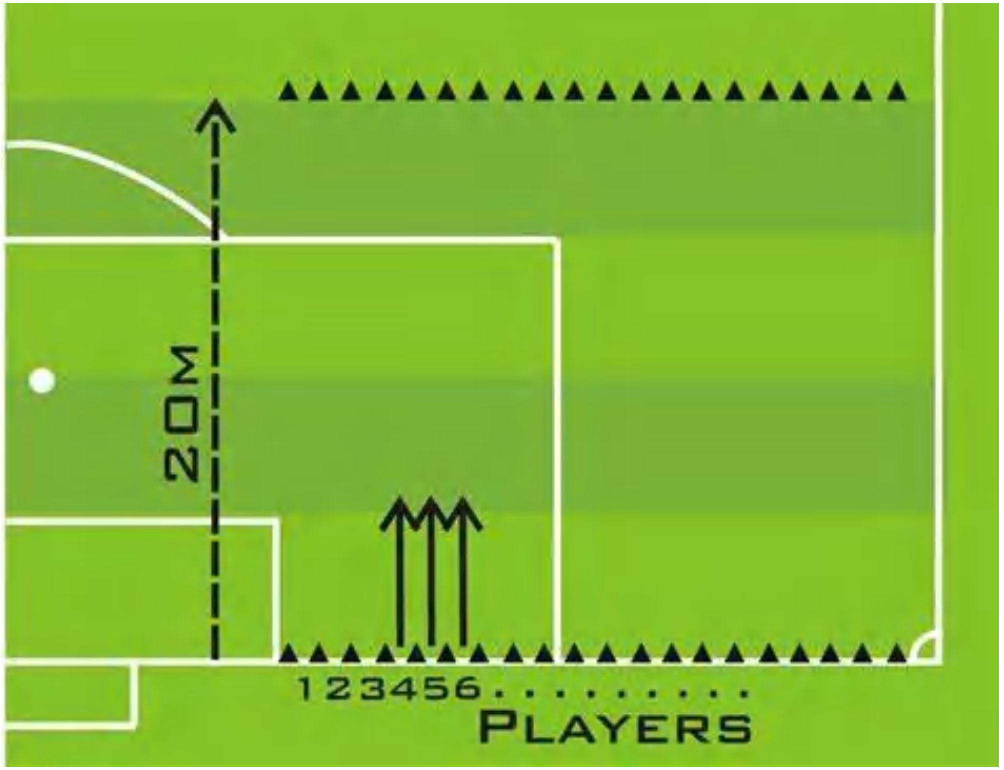

International Journal of Environmental Research and Public Health

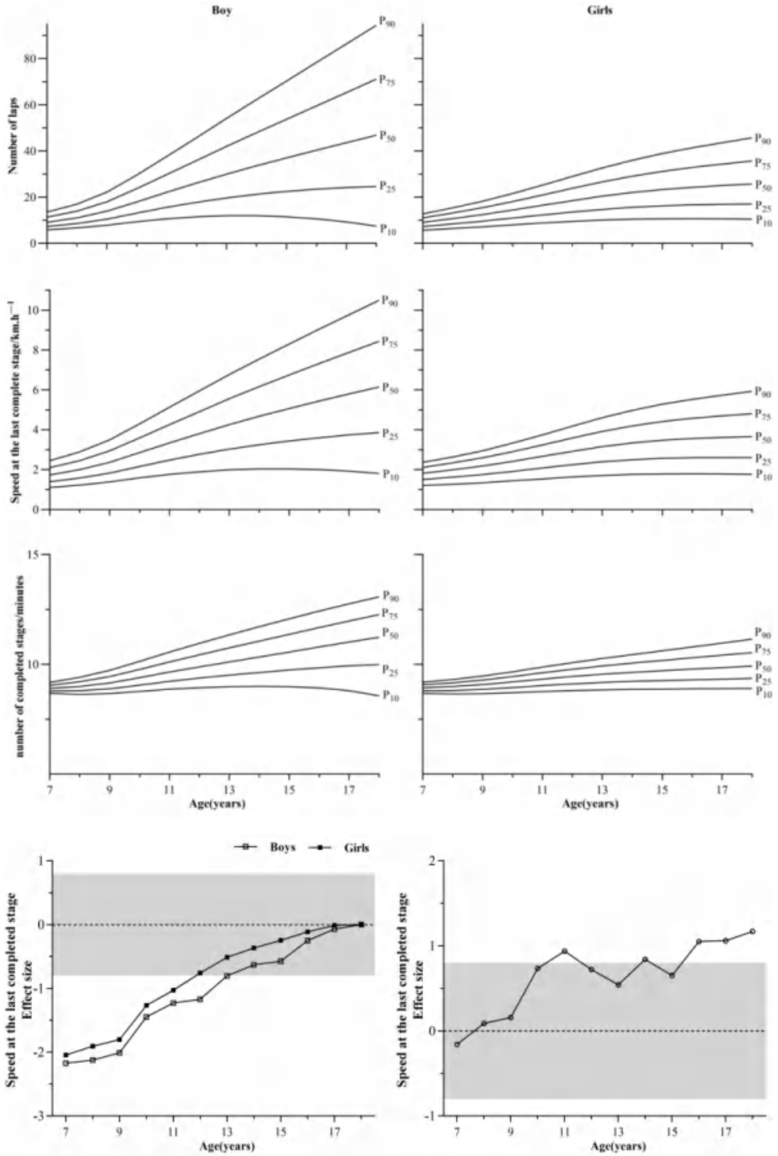
MDPI

Article

The Multistage 20-Meter Shuttle Run Test Reference Values for Tibetan Children and Adolescents in Tibet, China

Xiaojian Yin [1,2,*], Feng Zhang [1,2], Pengwei Sun [1,2], Yuan Liu [1,2] and Yaru Guo [1,2]





Access to quality services

Health and social care sector

- Develop evidence-based coordinated health and social care services and integrate CNS disorders into existing relevant health services (at all three levels), ensuring continuity of care across levels and disciplines.
- Establish, strengthen and train skilled interdisciplinary health and social care teams to diagnose, treat and manage CNS disorders and identify/treat carer stress.
- Expand the role of specialists to train and supervise generalists.
- Improve availability and appropriate use of essential medicines and diagnostics for CNS disorders, including workforce training on their use.
- Provide accessible and evidence-based information on available resources for carers in the community.
- Develop mechanisms to involve people with neurological disorders and their carers in care planning.

Education

- Include growth monitoring and neurodevelopmental assessments in school health programmes for early diagnosis and intervention.
- Provide robust primary, secondary and university-level education for the future health and social care workforce, including continuing education.

Legislature and governance

- Implement social and financial protection schemes for people with CNS disorders and their carers (e.g. general health insurance, disability pension, tax benefits, or flexible working hours).
- Establish transparent regulatory frameworks for health products and diagnostics.
- Develop mechanisms to involve people with CNS disorders and their carers in policy-making and legal review.

Infrastructure, urban planning and housing

- Ensure availability of public transportation to access health facilities within the community.

Ecology, nature and climate

Finance and economy

- Dedicate a portion of the health budget to the management and prevention of CNS disorders, including access to essential medicines.
- Implement social and financial benefits/ financial protection for carers.

Employment

- Address projected health workforce needs in the future.
- Establish compensation and incentives for workforce trained in CNS disorders to work in underserved areas.
- Implement employment protection schemes for carers (e.g. leave or flexible working hours).

Civil society can play a fundamental role in driving popular discourse about brain health, raising population awareness, and reducing stigma