# The battle for better brain health

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If you are one of over a billion people worldwide who suffers from migraines, you know how painful and debilitating they are. But did you know that migraines are much more than a headache? They are actually a chronic neurological disease - and one which may soon have a cure.

One in seven people suffers from migraines [1], including 10% of children [2], but the winners of the 2021 Brain Prize [3] may have a cure. Migraines have long been attributed to stress, but scientists have now found a chemical trigger called CGRP and have developed blocker drugs. They've worked on 60% of the people who have tried them. This is not only good news for people afflicted with migraines - it's also a sign that we are on the right track to mapping the brain and finding cures to more of the neurological disorders that affect it.

## What is brain health and why does it matter?

The brain is by far the most complex organ of the human body, allowing us to sense, feel, think, move and interact with the world around us. The brain also helps regulate and influence many of our body's core functions including those of the cardiovascular, respiratory, endocrine and immune systems.

Nearly one in three people globally will develop a neurological disorder at some point in their lifetime, which means almost everyone will be affected either directly or indirectly. Further, the financial costs of neurological disorders are enormous, with common neurological disorders accounting for US$789 billion in the United States alone [4].

Brain disorders like stroke, migraines, and dementia are currently the number one cause of disability globally; and are the second leading cause of death, responsible for nine million deaths per year, with eight million of these being attributable to stroke and dementia.

There are many brain disorders, but these are some of the most common:

- Dementia/Alzheimer's disease
- Stroke

- Epilepsy
- Headache disorders
- Motor neuron disease
- Multiple sclerosis
- Parkinson disease
- Mental disorders (eg, schizophrenia, depression, bipolar disorder, alcoholism, and drug abuse)

What determines who will be affected by a brain disorder? There is still no clear answer, as a multitude of factors can affect our brain health from as early as pre-conception [5]. In fact, all of the interactions we have with people and our environment drive a constant adaptation of our brain structure and functioning - this makes the brain an especially challenging organ to study.

Since no single factor can account for a person's brain health outcomes, many factors are categorised into clusters:

- Physical health
- Healthy environments
- Safety and security
- Learning and social connection
- Access to quality services

Brain health determinants are often interlinked and can be affected by other external factors. For instance, structural inequities associated with racism, ethnic and religious discrimination, or other systematic causes of oppression and marginalization tend to have an important influence.

## Brain health and equity

Nearly one in three people globally will develop a neurological disorder at some point in their lifetime - but these people will not receive equal treatment. Vast inequities in access to health care are driven by socioeconomic factors, leaving people in low- and middle-income countries at a clear disadvantage [6]. For instance:

- Only one in 10 people living with dementia in low-income countries receive a diagnosis.
- Only one 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 are 7.1 people in the neurological workforce/100K population in high-income countries vs 0.1/100K in low-income countries. This is a 70-fold difference in the availability of neurologically-trained workforce.

There are also vast disparities in exposure brain health risk factors, which lead to cycles of poverty and increase health inequities. Here are just a few examples:

- 43% of children under the age of five in low- and middle-income countries (nearly 250 million children) were at risk of not reaching their developmental potential due to extreme poverty and stunting [5]. Missed developmental potential for this reason is projected to cause 26% lower annual earnings in adulthood.
- WHO estimates that 99% of all people worldwide breathe polluted air in their ambient environment, which poses grave threats to brain development in early life and brain health across the life course. The areas with the most polluted air are in low- and middle-income countries and in lower-income communities in all countries.
- Globally, an estimated five million people are diagnosed with epilepsy each year. In high-income countries, there are estimated to be 49 per 100 000 people diagnosed with epilepsy each year. In low- and middle-income countries, this figure can be as high as 139 per 100 000. This is due in part to the lower availability of preventive health programmes and accessible care.

Additional barriers to accessing services include limited social and financial protections for people with neurological disorders, lack of access to medicines and diagnostics, as well as stigma and discrimination.

## Brain disorders and our aging population

Human ageing is mainly reflected in the aspects of brain ageing and degradation of brain function. The number of people aged 60 years and over worldwide was around 900 million in 2015 and is expected to grow to two billion by 2050 [7]. With the increases in population ageing and growth, the burden of neurological disorders and challenges to the preservation of brain health steeply increase. In the coming decades, governments will face increasing demand for treatment, rehabilitation, and support services for neurological disorders.

To promote optimal brain health, we need a better understanding of the mechanisms of brain function and dysfunction. Yet, little is known about the working mechanism of the brain. Although we have made considerable developments in neuroscience in recent decades, further investigation is needed to identify effective approaches to treatment and improve brain function.

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