MENTAL AND NEUROLOGICAL DISORDERS:
Innovative therapies, innovative collaborations
This publication provides an overview of mental and neurological disorders (MNDs) from the perspective and experience of the research-based pharmaceutical industry. It shows MNDs are responsible for a growing and significant health and employment burden which has an enormous impact on individuals and society.

The direct and indirect costs of these disorders are high, and more attention needs to be paid to their deleterious effects on society. Furthermore, the indirect costs should be addressed and taken into account when policy makers assess the need for new treatments, as indirect costs account for more than 60% of the total costs.¹

Many MNDs are still not very well understood, which poses a challenge on inventing breakthrough medicines and complicates efforts to improve diagnosis and treatment. This situation presents an important and urgent challenge for the research-based pharmaceutical industry, but also for governments, the World Health Organization, patient groups, and many other stakeholders across the scientific, social, financial, employment and health community.

THE SOLUTION REVOLVES AROUND TWO TYPES OF INNOVATION:

✔ The first is pharmaceutical innovation that will address unmet need, lead to new medicines, and reduce the devastating impact of MNDs globally. Scientific innovation in this area is extremely challenging, with therapies requiring on average 35% more time to obtain regulatory approval compared with medicines for treating other disease areas.² The complexities of studying the brain and behavior are among the hurdles innovation needs to overcome to be successful in this area.

✔ The second is innovation in policy and multi-stakeholder action to address MNDs. The health, social and economic stakes are high, warranting a robust collective response from governments and across sectors. Within the health sector, the co-morbidities between MNDs and other non-communicable diseases (NCDs) need to be better addressed. From a government perspective, the impact of MNDs should be considered beyond the health sector alone, and include the social and labor ministries.
ADDRESS SCIENTIFIC CHALLENGES IN PARTNERSHIP:
MND research requires a deep insight into both the clinical world—defined by a complex mixture of subjective assessments and indirect measures—and the molecular world—defined by objective molecular parameters. There is an opportunity for a collaborative effort across the R&D pharmaceutical industry, academia and regulatory agencies. An example is to facilitate higher efficiency in clinical development programs through clinical trial processes built on aligned designs and joint use of resources.

LOOKING TO SPEED UP INNOVATION:
Push and pull mechanisms, such as product development partnerships (PDPs), advanced market commitments, and grant-giving to research entities could help incentivize research and accelerate the development of new therapies. The complexity of the brain, the multidisciplinary nature of research, and the longer time taken to bring new therapies to market can discourage investment in this area. New medicines offer hope of reducing the devastating impact of MNDs globally, but innovative and holistic solutions will require a fundamental understanding of the diseases. Solutions will also require ending fragmentation across sectors, as well as leveraging the efforts between our industry, governments, patient organizations, the WHO and other stakeholders in partnership. Such an example is One Mind For Research, a broad consortium that aims to bring health actors together to accelerate the « research-to-cure » time needed to deliver new therapies. ³
RESHAPING THE HEALTH APPROACH TO MND SERVICES

ACT EARLY:
Providing robust health services for MNDs should be viewed as an investment rather than a cost. Diagnosing and treating conditions early and effectively has the potential to stave off the costs of managing complex mental disorders that have been allowed to worsen.

ESTABLISH TARGETS:
The precise configuration of health services varies according to local needs and culture. However, effective services are built on a clear mental health policy that establishes the vision and values underpinning service delivery.4 This should define targets and timeframes, along with specifying the resources and finances needed to deliver. A coordinating unit with ultimate responsibility for implementation is a key ingredient in successful mental health reforms.

PROMOTE BEST PRACTICES:
Effective MND services should be developed in line with the best available evidence. This requires strong continuing medical education programs and networks for sharing best practice locally, nationally and internationally.

INTEGRATE MENTAL HEALTH SERVICES:
Talking openly about disorders, their prevalence, and the prospects of effective management can transform health outcomes for those affected by MNDs and minimize stigmatization. Central to this tenet are services delivered at primary health care level, which are the most accessible, affordable and acceptable to local populations. By integrating mental health into these services, access is improved, detection is increased and effective treatment is more likely.5 This has practical advantages insofar as mental, neurological and addictive disorders are often linked with other health problems. Primary care services for mental health are less expensive than psychiatric hospitals and positive outcomes are achievable. This can lead to further stepping up collaborations with other government and non-government actors.6
ADDRESS THE CO-MORBIDITIES BETWEEN MNDs AND NCDs:
There is ample space for policymakers to tackle MNDs while considering the risks they pose towards developing other NCDs. Patients with undiagnosed or untreated MNDs are at higher risk of engaging in substance abuse, smoking, and being overweight. These are all risk factors for developing NCDs. Research has also found unipolar depressive disorder to be associated with increased prevalence of chronic diseases. These co-morbidities result in lower life expectancies and higher premature mortality rates compared with those who do not suffer from MNDs. By the same token, nearly 50% of people who suffer asthma also suffer from an MND, and diabetes complications are linked with major depressive disorder. Conversely, people with good mental health can develop buffers against NCDs, mainly through better lifestyle behaviors and reduced stress.

REDUCE STIGMA:
Almost one in four people will experience mental disorders at some point in their lives, yet social stigma of many MNDs remains. In some cultures, these disorders are not seen as ‘real’ diseases and are often viewed as a sign of weakness, misfortune or a curse. Misconceptions also persist regarding doctors’ ability to treat mental and neurological conditions. People suffering from MNDs face discrimination which not only risks making their illness worse but can also serve as a barrier to accessing mental health services. The WHO has warned that we are “facing a global human rights emergency in mental health”.

ENGAGE IN MULTI-SECTORAL COLLABORATION:
At the heart of future work on MNDs is collaboration and partnerships. Multi-stakeholder partnerships between academics, clinicians, industry, government, and non-government agencies are part of the answer to deliver evidence-based policies on MNDs and to develop new therapies. The Innovative Medicines Initiative (IMI), a public-private partnership in Europe aiming to speed up the development of better and safer medicines for patients, is a step in the right direction.

FOSTER INTEGRATED GOVERNMENT APPROACHES:
The problem we face today – and the growing burden MNDs will pose in the future – demands the expertise and input of a number of public policy areas ranging from health and social services to urban planning, education and housing. For governments, tackling the societal challenges presented by mental and neurological disorders requires an end to silo-based thinking and a more open, collaborative spirit.
Mental and neurological disorders (MNDs) are a set of illnesses affecting hundreds of millions of people around the world in developed and developing countries alike. These disorders comprise a range of central nervous system conditions that negatively impact mood, behavior, brain functioning, cognition, sensory or motor function. Overcoming the stigma which is sometimes attached to MNDs can be a challenge to their effective treatment. Far from being a set of subjective conditions, these disorders have biological as well as psychosocial triggers, and can be managed through a combination of medicines and complementary therapies.

- **MENTAL DISORDERS** include a broad range of psychiatric and psychological conditions. While each condition has its own symptoms, this set of disorders is generally characterized by abnormal thoughts, emotions, behavior and relationships with others.

  Mental disorders often become evident early in life, typically during the teenage years. 75% of all mental illnesses have developed by the age of 24. Most of these conditions can be successfully managed, allowing the individual affected by the disorder to live a full and active life. However, many mental disorders are persistent and can recur.

- **SUBSTANCE ABUSE-RELATED DISORDERS** concern alcohol and also many other psychoactive substances.

- **NEUROLOGICAL DISORDERS** are diseases of the central and peripheral nervous system, the brain, spinal cord, cranial nerves, peripheral nerves, nerve roots, autonomic nervous system, neuromuscular junction, and muscles.

  These include Alzheimer's disease and other dEMENTAL DISORDERS, cerebrovascular diseases including stroke, epilepsy, migraine and other headache disorders, multiple sclerosis, Parkinson's disease, neuroinfections, brain tumors, traumatic disorders of the nervous system such as brain trauma, and neurological disorders which result of malnutrition.

  The causes of neurological disorders are many.11 They include faulty genes (e.g. Huntington's disease), development problems (e.g. spina bifida), degenerative diseases (e.g. Parkinson's disease and Alzheimer's disease), diseases of the blood supply (e.g. stroke), injuries to the spinal cord and brain, seizure disorders (e.g. epilepsy), cancer (e.g. brain tumors), and infections (e.g. meningitis).
The WHO estimates that 700 million cases of mental and neurological disorders are reported annually, accounting for 13% of global disease burden. MNDs affect people in every country of the world, shaping how they live and work. While the burden of MNDs is likely to rise in the years ahead, the proportion of the health budget earmarked for these conditions is already low relative to their social and economic impact.

MNDs BY THE NUMBERS:
The numbers of people directly affected by MNDs worldwide are staggering.

An estimated:

- 350 million people live with depression
- 90 million live with a substance abuse disorder
- 25 million live with schizophrenia
- 50 million people have epilepsy
- 35.6 million people suffer Alzheimer’s disease and other dementias
DISEASE BURDEN:
MNDs are responsible for 13% of the global disease burden. Furthermore, diagnosis and reporting of MNDs is not consistent across the world and official figures are likely to underestimate the true prevalence of several of these conditions. Even the most accurate figures for direct morbidity and mortality fail to tell the full story. By placing people under stress, mental disorders increase the risk of poor outcomes for those with non-communicable diseases and injury.

MNDs AND NCDs:
About 30% of the total burden of non-communicable diseases is due to mental and neurological disorders. MNDs can place a considerable physical and emotional strain on those directly affected as well as on their families.

COUNTING THE COSTS:
MNDs impose a significant cost on individuals, society and economies. In the European Union, for example, mental disorders account for 3-4% of GDP, the majority of which is attributed to indirect costs such as lost productivity. The World Economic Forum estimates that the global cost of MNDs was US$2.5 trillion in 2010 but this will increase to US$6 trillion by 2030. About two-thirds of this comes from indirect costs, such as lost productivity, sick leave, and early retirement, with the remaining third from direct costs.

THE GLOBAL COST OF MNDS: TODAY AND TOMORROW.
Source: The World Economic Forum
MNDs AND LOST PRODUCTIVITY:
Depression is the most predominant mental disorder among working-age patients. In the workplace, it is a leading cause of lost work productivity, sick leave and early retirement. Depression at work costs employers $44 billion a year in lost productive time. In Europe, the cost of depression was estimated at 92 billion Euros in 2010, affecting more than 30 million people.
Workers with depression report on average 5.6 hours per week of total health-related lost productivity time more than those without depression. Lost productivity due to absenteeism and presenteeism represent over 50% of all costs related to depression. The World Economic Forum has recently estimated more than 16000 billion dollars will be lost due to lost productivity in the next two decades.

Cognitive dysfunction as part of depression, can entail concentration difficulties, indecisiveness and forgetfulness. It is a frequent but lesser known part of depression and has a significant impact on quality of life and the ability to function professionally and socially. Cognitive dysfunction is a key feature of major depressive disorder, in both young and old adults, and has been reported to be present 94% of the time during major depressive episodes. Cognitive dysfunction in patients with major depressive disorder contributes to impaired work function and predicts poor occupational outcome. The toll MNDs often take on families is profound, often requiring parents or spouses to reduce their productivity and sometimes adding strain which can trigger ill-health among those caring for people with mental disorders. Where developed health and social care systems exist, some of the burden of care also falls on the state. Long-term, debilitating MNDs can require lengthy – sometimes even life-long – care. For society and the wider economy, lost productivity due to premature deaths caused by suicide can be broadly equivalent to the number of fatalities from road traffic accidents. For people with MNDs who are employed, the capacity to work productively can be impaired.

SHAPING MND BUDGETS TO MEET THE BURDEN OF DISEASE:
Despite the health, social, employment and economic impact of MNDs, the proportion of health spending devoted to their prevention, treatment and cure is relatively low. While MNDs are among the most costly medical disorders to manage, millions of people affected by them do not receive adequate treatment. On average, less than US$2 per person, per year is spent on...
mental health.25 Within this, a high degree of variation is found. High-income countries spend US$44.8426 while low-income countries spend just US$0.25.27 Globally speaking, 67% of spending on mental health is directed towards psychiatric hospitals.28

**BURDEN OF MENTAL DISORDERS AND BUDGET FOR MENTAL HEALTH**

- **11.48%**
  - Proportion of disability-adjusted life years (DALYs) attributable to mental disorders (Source: http://www.who.int/healthinfo/statistics/bodprojections2030/en/index.html)

- **3.76%**
  - Median proportion of total health budget allocated to mental health (Source: Mental Health Atlas, WHO, 2005)

Budget gap: mental health budgets are low compared to the burden of mental disorders


**A GROWING HEALTH PRIORITY:**

MNDs are expected to become a greater burden globally in the years ahead. One disease – major depressive disorder – is expected to be the worldwide leading cause of disease burden by 2030.29 Neurological conditions are also likely to rise in line with demographics. Alzheimer’s disease affected 36 million people globally in 2010 but will surge dramatically to 115 million by 2050.30 Furthermore, the anticipated increase in non-communicable diseases is also likely to give rise to higher rates of MNDs. Through research and innovation, new medicines can be brought to patients, reduce the disease burden, and help to contain the socio-economic costs of MNDs. Greater focus on raising awareness of MNDs and reducing stigma, along with funding for basic mental health care and prevention programs, can foster more efficient management of this growing health challenge.
MNDs have always been with us. However, it is only in recent decades that scientific advances have allowed a deeper understanding of how the brain works, thus helping to demystify MNDs. This in turn paved the way for innovative treatment options, allowing these conditions to be effectively managed. This understanding, along with new therapies, has helped to reduce the stigma that has historically been associated with mental and neurological disorders.

LEGACY OF THE PHARMACEUTICAL INDUSTRY

Over the past 50 years, advances in science have changed the way MNDs are perceived by society. In past decades, conditions such as bipolar disorder and epilepsy were viewed through a lens of stigma and superstition. Better understandings of the causes of these disorders and—crucially—better tools for managing MNDs have helped dispel long-standing myths.

In the first half of the 20th century the first-line treatment for managing depression and schizophrenia was detention in a psychiatric institution – a practice which had a profound effect on patients and their families, as well as soaking up scarce financial and human resources. Today, pharmacological breakthroughs allow patients to be treated in the community where they may continue to participate in family and social life. New medicines and improved psychosocial interventions are facilitating the “de-hospitalization” of long-term psychiatric inpatients.

There are benefits too for people with less severe mental disorders. Getting symptoms under control can be critical factors in giving people the opportunity to enter – and stay in – the labor market. According to the OECD, severe mental disorders are enduring and chronic, and have a larger impact on disability and work capacity than common mental disorders. The latter, however, are still responsible for a high degree of losses of output, productivity and workdays, have greater prevalence and are often not recognized or diagnosed. Based on epidemiological studies, it is assumed that 5% of the working-age population in every country have a severe mental disorder and another 15% have a moderate mental disorder.

Substantial and sustained investment in research by the pharmaceutical industry has made a significant contribution to this progress. Not only did advances in basic scientific understanding
help to demystify brain disorders, the industry’s commitment to medicine development has delivered therapies for conditions once viewed as untreatable.

The research-based pharmaceutical industry continues to invest in new therapies, in better understanding, and in sharing the latest scientific knowledge with healthcare professionals. Much progress has been made but we are a long way from reaching our goals. For some diseases there are no effective treatments; for others the best available therapies can be improved upon.

**PSYCHOPHARMACOLOGY: A HISTORY OF PROGRESS**

The 1950s brought a boom in psychopharmacology, which was to revolutionize the treatment of mental disorders. In the first half of the 20th century, physicians’ treatment options were limited and not always evidence-based. Insulin coma therapy, sleep-deprivation therapy, and shock treatment were used for various forms of mood disorders, with mixed results. Today there are dozens of antipsychotic medications on the market, each of which is the result of a lengthy and painstaking research effort by scientists building on the body of knowledge that began accumulating six decades ago.

For all the effort that has gone into psychopharmacology, it was a dose of scientific serendipity that led to the discovery of the first antidepressants. Researchers in an asylum in Switzerland were searching for schizophrenia treatments when they chanced upon a chemical compound that affected the brain’s neurotransmitters – the chemicals responsible for sending messages through the nervous system. While this was not the answer to the problem at hand, it made an enormous
difference to patients suffering from depression. The medicine was the first of a class of medicines known as tricyclics and soon reached patient populations.

Yet the science of psychopharmacology was young. As research progressed, it became clear that while the new wave of medicines provided relief for between 60% and 80% of patients, they could cause serious side effects, notably weight gain and sluggishness. A more targeted class of antidepressants – the serotonin reuptake inhibitors (SSRIs) became available in the late 1980s and 1990s. The positive effects were comparable to the older medicines but the risks of serious side effects were much reduced.

These giant leaps forward revolutionized how we care for people with mental disorders, improving outcomes for patients, giving a greater range of treatment options from which clinicians can choose, and providing value to healthcare systems seeking effective treatment for otherwise more costly conditions.

TREATMENT OPTIONS
Modern approaches to the management of many MNDs draw on a combination of psychosocial and pharmacological interventions. Indeed, research suggests that for several of the major mental disorders, treatment plans including both pharmacological intervention and psychotherapy are more effective than either treatment method used alone.34

For neurological conditions, medication plays a lead role in disease management, supported where
appropriate by input from multidisciplinary teams. For example, people with movement disorders such as Parkinson's disease often benefit from the input of physiotherapists and social workers.

Psychosocial and pharmacological therapies are both proven to reduce the burden of major depressive illnesses. However, these treatments act in different ways. Cognitive behavioral therapy (CBT) affects the cortex – the ‘thinking’ part of the brain – reducing stress and influencing mood. This helps people to cope with emotional strain. Medicines, on the other hand, work from the ‘bottom up’ by targeting the neurotransmitters in the brainstem that drive basic emotional behavior. While talk therapy has its roots in psychology, pharmaceutical treatments build on the fundamentals of biochemistry.
Research challenges

INCENTIVES, COMPLEXITY, AND TIME

The human brain is, by several orders of magnitude, the most complex organ in the human body. There are 100,000 million nerve cells or more in the human brain, with 10,000 times as many connections between them. Through these connections the brain controls everything from the movement of muscles and the secretion of hormones to emotions and memory.\(^{36}\) The human brain has a complex folding structure and is difficult to observe directly. All of this makes it significantly more difficult to figure out the factors that can cause different MNDs and poses unique challenges for researchers working to develop new treatments.

A concerted approach to reprioritize brain research to match the burden from brain disorders is clearly needed. Academia, governments, patient organizations, and industry are all vectors for success. Push and pull mechanisms can be activated amongst these entities to accelerate basic research, enable medicine development, and foster access to new therapies.

Product development partnerships can integrate inputs from different sources to accelerate development of new therapies while dispersing the cost and risk of conducting R&D amongst several actors. Particularly for MNDs, grant-giving to research entities is a policy incentive that can accelerate much-needed basic research to understand the basic functioning of the brain.

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By the same token, organizations that represent patients suffering from MNDs must have a seat at the table as a full partner to identify barriers and collaborate to develop the appropriate solutions to improve patient outcomes.

**BRAIN RESEARCH NEEDS TO BE INCENTIVIZED**

The prevalence of MNDs is expected to rise in the coming decades, a trend that could weigh heavily on health budgets. Addressing and reducing this burden requires both substantial resources and commitment from all actors. No single stakeholder can take on this task alone: a broad coalition of industry, universities and policymakers need to pull together to support neuroscience. This challenge means tapping into the expertise of research-based pharmaceutical companies, the medical devices and diagnostics sector, bioinformatics firms and other private players. It requires the concerted efforts of researchers from across the academic spectrum ranging from biotechnologists and chemists to psychologists and engineers. Policymakers with expertise in health will be crucial but so too will be those with experience of social, economic and education policy.

Academic institutions and governments can devise supports for researchers and offer incentives for the commercialization of cutting-edge ideas. An example is working to make industry-liaison offices more effective so that ideas born in university laboratories can be transferred to experts with experience of turning this knowledge into medicines. Similarly, scientists working in industry can support academia by transferring technologies and know-how to universities engaged in the fundamental science to feed applied research. The relationship is symbiotic but must be nurtured in order to reach its full potential. Furthermore, governments should allocate more funds into basic research. The complexities of studying the brain call for new insights and discoveries in brain research, which can be then translated into novel therapies.

These advances could lead to revolutionary outcomes. It is estimated that a new treatment capable of delaying the onset of Alzheimer’s disease by five years would reduce the number of people with the disease by 43%, saving billions of dollars. Investment and incentives in this area are essential in order to manage the human, social and economic costs of MNDs.

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BRAIN RESEARCH IS COMPLEX AND INTER-DISCIPLINARY
The complex folding structure of the human brain has challenged leading scientists for centuries. While neuroanatomy researchers took centuries to show that specific areas of the brain are chiefly responsible for emotions, speech and movement, neuroscience has moved to a molecular level. Unlike the heart, the kidneys or the liver – each of which is complex in its own right – the brain defies direct observation. To understand how the brain affects human behavior, scientists and doctors must rely on a combination of subjective assessments and indirect measures given by molecular markers and a new wave of advanced imaging techniques.

Brain research requires a high level of broad and highly specialized expertise. Advances in genetics have added a new level to how scientists understand the brain. Describing the relationship between genetics, the environment and human behavior is a painstaking task. There is an opportunity to invest in large-scale longitudinal natural history studies that qualify and validate key biomarkers, which are crucial for the understanding of neurodegenerative diseases.

To understand how the brain affects human behavior, scientists and doctors must rely on a combination of clinical observations of symptoms, indirect measures given by molecular levels, and a new wave of advanced imaging techniques.38

BRAIN RESEARCH TAKES MORE TIME
For MNDs, not only does finding a potential therapeutic candidate take more time, the chances of taking that medicine from the lab bench to the patient’s bedside are lower than in other fields of medicine. Medicine research is expensive and time-consuming in all disciplines, taking between 10 and 15 years at a cost of around US$1.3 billion.39 But new therapies for brain disorders take 35% longer to complete clinical trials and receive regulatory approval compared to other new prescription medicines.40 Add to that the fact that only 1 in 10 molecules entering clinical trials for MNDs obtain approval, compared to around one in six for other disease areas, and it becomes clear why investment in brain research is a risky prospect.41
The promise of advances from new areas of research such as connectomics – the study of the connections between nerve cells in the brain – can be tempered by the time-consuming nature of the work required to make progress. For example, researchers spent 10 years producing a diagram of a roundworm brain, which has 300 nerve cells. Repeating the feat for the 100 billion or so nerve cells found in the human brain is a daunting project.

Research opportunities

Mapping of R&D efforts

Today, there are more than 300 new medicines in clinical trials or awaiting the green light from regulators. The search for new medicines to treat MNDs is shifting from a symptom-based approach towards the development of medicines that stop disease progression – or even prevent illness altogether. This involves major advances in early diagnosis and intervention, using validated behavioral and biomarkers—which indicate the presence and severity of disease—to facilitate personalization of treatments, which could yield significant improvements for millions of people. Researchers are also focused on preventative strategies such as vaccines and cognitive protective approaches. A deeper understanding of the underlying causes and triggers behind mental disorders promise to give doctors the tools to treat psychological disorders almost as effectively as physical disorders.

Depressive disorders

54 new compounds are in development for the treatment of depression. Antidepressants are among the most commonly prescribed medicines yet not all patients respond in the same way to these therapies. Adequate treatment is a critical factor in reducing symptoms and improving employment prospects for people with depression. More than half of patients do not achieve adequate response following the first antidepressant treatment and remission rates are progressively lower for each successive treatment step.

Researchers are looking at how variations in the human genome influence individuals’ susceptibility to disease and responses to medicine treatments. In doing this, scientists hope not just to develop better therapies but to help find the right kind of therapy for the right kind of patient.
This is where pharmacogenomic research comes in. Researchers are looking at how variations in the human genome influence individuals’ susceptibility to disease and responses to medicine treatments. In doing this, scientists hope not just to develop better therapies but to help find the right kind of therapy for the right kind of patient. For this strategy to deliver on its full potential, patients need to be characterized in detail according to their psychopathology, early experience, life events and previous treatment response, as well as neuropsychological performance, sleep electroencephalography and neuroendocrine parameters.

This daunting task is being tackled by initiatives such as the Munich Antidepressant Response Signature (MARS) project which collects data with a view to predicting how patients will respond to treatments. Developing an effective way to separate patients into clinical sub-groups would allow doctors to choose therapies more likely to be effective but with a lower chance of side effects.

SCHIZOPHRENIA is another challenging mental disorder that makes it hard to tell the difference between what is real and not real, think clearly, have normal emotional responses and act normally in social situations. The disease occurs at similar rates in all ethnic groups around the world. Symptoms such as hallucinations and delusions usually start between the ages of 16 and 30, thereby impacting economic productivity in the prime of life.

Antipsychotic medications are the most effective treatment for schizophrenia as they change the balance of chemicals in the brain and can help control symptoms. At least 37 new compounds are under investigation to treat this complex disorder. Some promise much-improved routes of administration are on the horizon, including a one-monthly dose and a high-dose formulation. Others are under investigation to address neuronal, neurotransmitter and serotonin receptors.

NEUROLOGICAL DISORDERS include Parkinson’s disease, Huntington’s disease, amyotrophic lateral sclerosis (ALS), Alzheimer’s disease, multiple sclerosis (MS), stroke, and spinal cord injury. These are caused by a loss of neurons and glial cells in the brain or spinal cord. Cell replacement therapy and gene transfer are opening up new avenues for researchers working to restore lost
neurological function. Both neurons and glial cells have been successfully grown from stem cells in laboratories, sparking hope that stem-cell-based transplantation therapies could be on the horizon. Scientists are also looking at ways to prevent brain cell death and even restore memory loss caused by Alzheimer’s disease. Nearly 100 medicines are undergoing development for Alzheimer’s Disease and other dementias.

Medicines targeting autistic spectrum disorders are also being tested. The US Food and Drug Administration’s (FDA) decision to ‘Fast Track’ five potential therapies in this area has incentivized much-needed progress in this area. Other compounds in development by research-based companies include addictive disorders (26 in development), anxiety disorders (26 in development), attention-deficit/hyperactivity disorder (20 in development), eating disorders (3 in development), and sleep disorders (22 in development), amongst others.
THE NUMBERS
More than 700 million cases of mental and neurological diseases (MNDs) are reported each year worldwide, causing human suffering and substantial social, employment, and economic challenges for policymakers.

THE SITUATION
Forecasts indicate the burden of MNDs will increase in the years ahead, yet the proportion of health spending devoted to MNDs is relatively low.

UNDERSTANDING BRAIN AND BEHAVIOR
The impact of MNDs is often not understood and stigmatized. However, advances in science over the past 50 years have helped to demystify many of these conditions. The pharmaceutical industry has invested in deepening the understanding of how the brain works and has developed therapies to help manage these conditions.
THE ROLE OF SCIENCE

The brain is a uniquely complex organ and research in this area is very difficult, expensive, and time-consuming. Developing new medicines for MNDs and bringing them to market takes longer and is more expensive than developing medicines for other serious disorders.

INNOVATIVE THERAPIES

Advances in genetics and genomics offer promise of new approaches to R&D that capitalize on the potential of state-of-the-art diagnostics and personalized medicine. This requires an enormous collaborative research effort. There are more than 300 new medicines in the pipeline but, given the complexity of the disease, many of these will not reach patients. Policymakers can play a key role in supporting new therapies by incentivizing brain research and medicine development.

INNOVATIVE COLLABORATIONS

Addressing MNDs requires innovative policies and leveraging the efforts amongst our industry, governments, patient organizations, the WHO and other stakeholders in partnership. Developing robust mental health systems and embedding MND services in primary care can improve access and outcomes. The impact of MNDs on individuals and societies calls for intersectoral cooperation of government ministries. Push and pull mechanisms, including product development partnerships (PDPs), advanced market commitments, and grants to incentivize research are innovative ways of going forward.
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