The Future of Mind Health and Well-being

THE AXA 2020 FORESIGHT REPORT

Foreword

One out of five people in the world today experiences a mental disorder in any given year. Mind Health issues can affect anyone, regardless of age, race and economic or social class, and most of us will be affected at some point in our lives, indirectly if not directly. Given the ageing of populations in most regions of the globe and the higher incidence of mental health disorders in people who suffer from chronic disease, mental health issues are likely to rise. Moreover, almost 50% of mental illnesses begin at an early age, thus affecting youth and having potentially devastating outcomes on lives at a stage where diagnosis is still weak. Women, who play a predominant role in caregiving both for the elderly and children and often head single-parent families, seem to have a higher and more persistent prevalence of depression and anxiety. Clearly, mental health is a public health, economic and societal issue. Despite this, it still goes largely undiagnosed, and patients appear reluctant to seek professional help because of the stigma associated with these disorders. Indeed, mental health is only recently gaining traction and being put on the agenda.

As a responsible global insurer and a major private sector player, AXA has multiple roles to play in the mental health area. Firstly, by helping to shed light on the issues surrounding mental health, raising awareness to better plan prevention and treatment strategies, particularly in areas where cures exist yet are not applied because of poor or tardy diagnosis. Secondly, as a global employer, by promoting work environments that take into consideration overall physical and mental well-being. Lastly, as a forward-looking company committed to supporting research and innovation through new products and services and the renewed funding of scientific projects to continue building our society's resilience to tomorrow's challenges.

This Foresight Report sets out to convey a picture of current and future challenges through different lenses: health, new technology, the environment and climate change. The issues of mental health across one's lifespan, understanding if and how technology can support diagnosis and treatment. It seeks to explore the influence of both environmental and socio-economic factors on overall well-being.

Understanding the trends that are shaping the future of mind health and well-being is the best way to be prepared to face them.

Ulrike Decoene

GROUP HEAD OF COMMUNICATION,
BRAND AND CORPORATE RESPONSIBILITY

Introduction

Whereas mental health tends to be associated with severe mental conditions, the term in fact refers to a spectrum going from good health to severe illness and is defined by The World Health Organization as “a state of well-being in which an individual realizes his or her own abilities”. The largest proportion of mental health issues are not in fact severe and enduring but mild to moderate, short-lived mental health conditions. Statistics show that depression affects an estimated 300 million people worldwide, and anxiety disorders concern almost 4% of the world’s population. These two conditions constitute the bulk of mental health problems.

Though most mental illnesses are treatable, some estimates suggest that two-thirds of people experiencing mental health issues go unsupported[1]. Stigma, lack of prevention, a shortage of mental health specialists and the absence of large-scale technology-based initiatives help explain this paradox and the challenges ahead to improve people’s overall well-being.

From a long-term perspective, common disorders, among the leading causes of morbidity and mortality today, will account for a $16 trillion cost to the global economy by 2030[2]. Some of these costs will be direct for healthcare and medicines, but most will be indirect and will contribute to a loss of productivity. This means mind health will become a growing concern for society and business.

This Foresight Report explores the future trends likely to be shaping mind health and well-being by 2030. We have intentionally chosen to interchangeably use the terms ‘mind health’ and ‘mental health’ as we do not only refer to conditions but to overall health related to the mind. The term ‘mind health’ is inclusive and less suggestive of a negative connotation, thus also participating in fighting stigma.

To explore the diverse dimensions of this global and complex subject, we have looked at mental health through the areas of general health, new technologies, the environment and socio-economics. Our “health dimension” focuses on three symptomatic mental illnesses at different stages in life. “New technologies” focus on the challenges of data-driven approaches to improve the quality of diagnoses, treatments and follow-ups in mind health; the “environment lens” introduces a more holistic approach to health, investigating its links with climate change, nutrition and local initiatives; and the socio-economics focus discusses how mental health is impacted by modern lifestyle and the “new happiness imperative”.

Last but not least, our foresight/fictional design scenarios and the emergence of new therapies provide a perspective on how mental health could be tackled in the future.

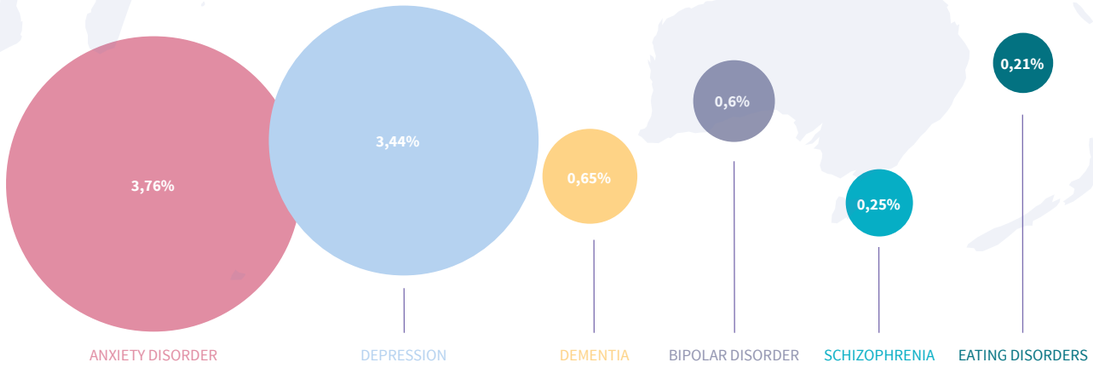
How this Foresight Report was built

The four chapters of this publication are organized in the same way: around 3 trends that we find particularly pervasive in the future of mind health and well-being. Each chapters, opening and ending shed new light on these trends through additional data, specifics, definitions or forward-looking elements. These were drawn from expert interviews, reports, the press, podcasts and documentaries.

THE FORESIGHT TEAM

Share of the world population with a given mental health disorder

Sources: IHME, Global Burden of Disease, WHO (2017)



CHAPTER 1 – MIND HEALTH

Health and the mind

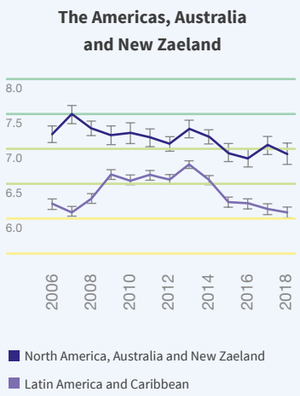
Why is mind health a priority for healthcare?

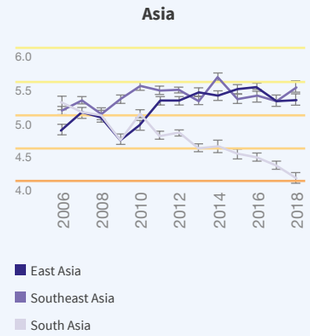
From Post-Traumatic Stress Disorder to anxiety and addictions, 20% of the world's population is bound to suffer from a diagnosable mental illness at some point in their lives. These diseases are often long-lasting and can be severely debilitating.

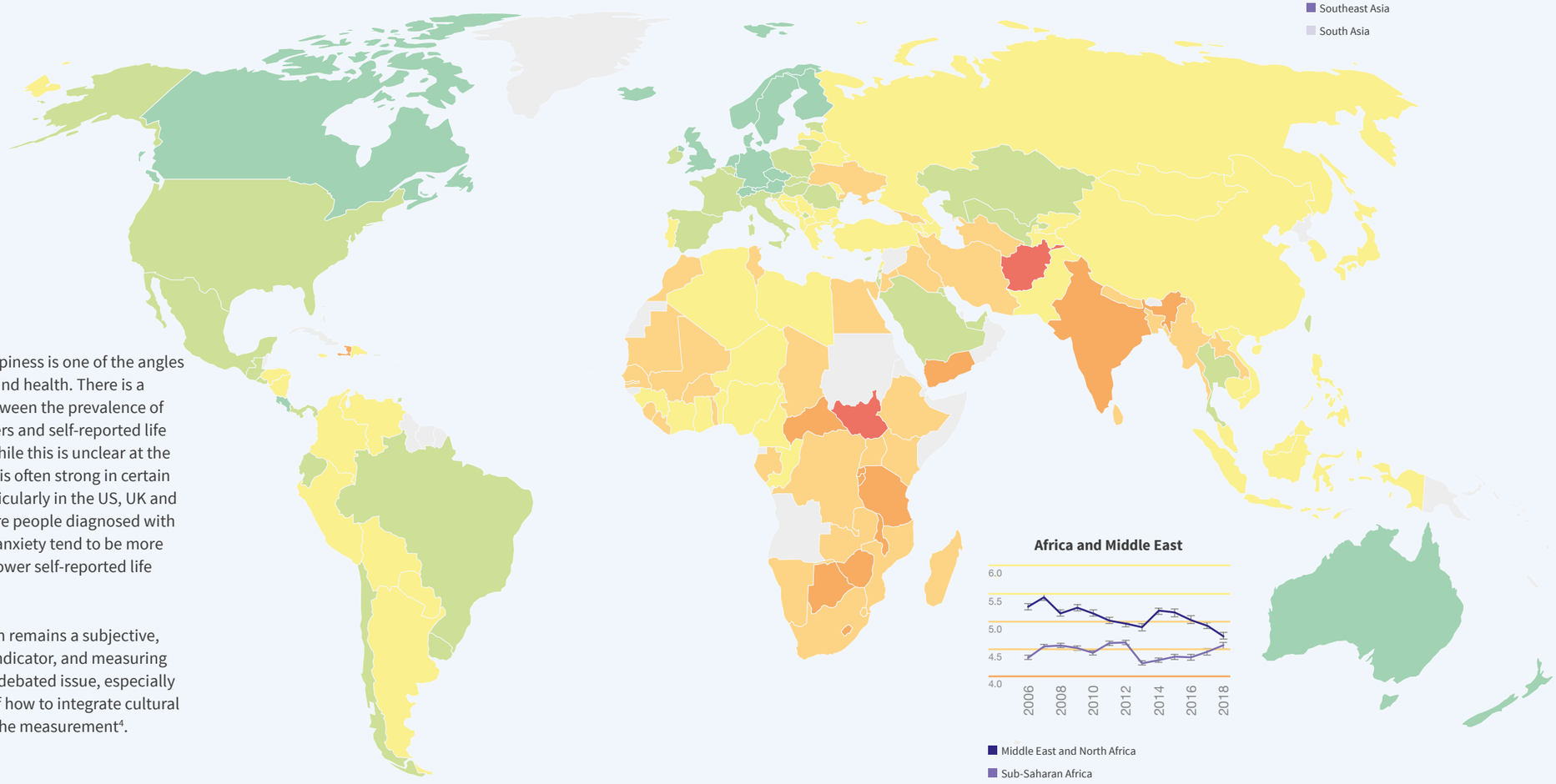
The majority of today's mental illnesses present symptoms early on. Acting on prevention and early detection to reduce their long-term consequences provides a major opportunity to improve mind healthcare for future generations. As the population grows and ages, questions arise as to the viability and sustainability of our current health care systems. Mental illnesses are complex and multifaceted, so their treatment should be better integrated into individuals' general health management throughout their lives.

Mental conditions affect all stages of life from childhood through old age. With an aging world population, an increasing number of people suffer from age-related mental illnesses such as dementia. Occupational stress is also on the rise, and the recognition of burnout and its consequences on the workforce is gaining momentum. Meanwhile, as over 75% of brain-related diseases develop before the age of 25, mind health prevention among youth is also a leading priority.

World map of self-reported life satisfaction





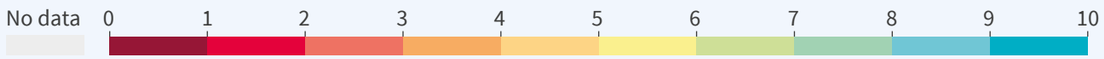


Based on the World Happiness Report data and research on self-reported life satisfaction, this map shows on a scale of 0 to 10 the happiness scores country by country. There are large differences across regions and countries: Nordic countries score the highest, with an average above 7; the lowest scores are mainly reported in Africa and the Middle East, with scores below 3.

Self-reported life satisfaction shows a downward trend in the Americas, Australia, New Zealand, the Midde East and NorthAfrica, and especially in South Asia. A relatively stable trend appears in Sub-Saharan Africa, East and Southeast Asia; and there is a slight upward trend in Europe.

Measuring happiness is one of the angles of assessing mind health. There is a correlation between the prevalence of mental disorders and self-reported life satisfaction. While this is unclear at the macro-level, it is often strong in certain countries, particularly in the US, UK and Australia (where people diagnosed with depression or anxiety tend to be more likely to have lower self-reported life satisfaction[3]).

Life satisfaction remains a subjective, self-reported indicator, and measuring happiness is a debated issue, especially the question of how to integrate cultural differences in the measurement[4].



Source: World Happiness Report (2019)

OurWorldInData.org/happiness-and-life-satisfaction/ • CC BY

Youth: the importance of early diagnosis

Key takeaways:

1. Given its serious consequences in adult age and positive outcomes of early treatment, addressing mental illness in young people is crucial to providing better livelihoods.

2. Largely unknown to the public, Borderline Personality Disorder and its implications are now increasingly recognized in mind health settings.

3. Treating mental disorders at their onset has shown successful results in preventing lifelong effects.

In 2018, 3 billion people – 42% of the world's population – were under the age of 25[5]. Although in steady decline, this percentage is expected to remain high and ultimately to reach just under 40% in 2030[6]. With over 75% of diseases developing before the age of 25, addressing the mind health risks specific to youth is pivotal.

Mind Health: Are young people at risk?

According to estimates, 10% of children and teenagers suffer from a clinically diagnosable mental illness[7], making it one of the leading causes of disability in young people[8]. About half of all cases of mental illness begin by the age of 14[9].

• **Media-consumption:** The under-25s are often labelled as 'digital natives' due to their handling of digital technologies. And yet, while they might better adapt to constant changes in technology, they are also more susceptible to social isolation[10], cyber-bullying[11] and withdrawal.

• **New family structures:** A growing proportion of youth has been raised either in a blended family or in a single-parent household, both of which have shown to impact mind health and generate symptoms of fear of abandonment or depression[12].

• **An image-obsessed generation:** "Millennials" spend twice as much as "boomers" on self-care essentials (workouts, diets, life coaching, personal well-being). They are also more concerned about their health and their image, and eager to monitor the latter daily[13].

Focus on Borderline Personality Disorder (BPD) and Youth

Considered a serious and common psychiatric condition, BPD is characterized by significant emotional instability and impulsiveness, as well as the development of a persecution complex and suicidal tendencies. Its impact and prevalence have become so significant that BPD is described by some as one of the most serious mind health problems in the field of psychiatry[14].

The clinical existence of BPD in adolescence has been the subject of debate for years, but people are only recently starting to become aware of its consequences. According to a 2018 study, 3% of adolescents suffer from BPD, with girls 5 times more likely than boys to suffer from the condition.

BPD can be treated but remains largely under-diagnosed today. According to a large survey conducted by the McLean Study of Adult Development[15], after 6 years of treatment, 74% of patients no longer show any symptoms. This increases to 94% after 12 years. Early treatment contributes to preventing life long consequences and diagnostic errors.

Studies have demonstrated that closer attention should be paid to reducing the time between the first signs of the disease, its diagnosis and the start of therapeutic treatment. Although more difficult to diagnose in its early stages, BPD symptoms are less severe and easier to treat in younger patients[16]. Indeed, the first five years of the disease are critical as it is during this period that the chances of remission are the greatest and the response to treatment is the most successful[17].

1 in 2

About half of all cases of mental illness begin by the age of 14
(source: WEF)

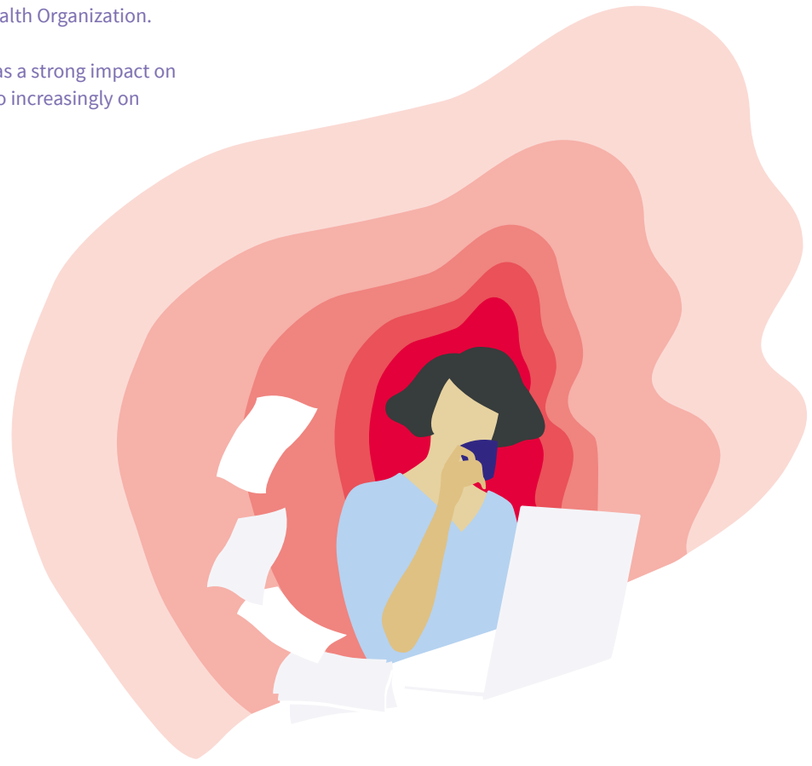
Burnout: the social cost of work fatigue

Key takeaways:

1. Working conditions have been identified as one of the main stress-inducive environments, with significant mental health consequences.

2. Burnout as a work-related syndrome is increasing and is now recognized by the World Health Organization.

3. The social cost of burnout has a strong impact on national health systems, but also increasingly on companies.



As the health consequences of stress are increasingly recognized, work conditions have become the subject of close scrutiny, with three main issues related to the workplace: burnout (physical or mental exhaustion), boreout (boredom resulting from mental underload) and brownout (disengagement resulting from loss of meaning).

Mental illnesses in the workplace, a collective burden

Yet, with most people spending at least a third of their adult life working, the workplace turns out to be a fertile ground for mental disorders to develop.

• A recent study conducted by the Yale Center for Emotional Intelligence finds that 1 out of 5 employees is highly engaged and at risk of burnout[18].

• Another study reveals that 95% of United States Human Resource leaders[19] find burnout to be negatively impacting workplace retention, often because of overly heavy workloads.

• Burnout is more prevalent among millennials, as younger workers (aged 18-29) today are twice as likely to report poor mind health than older workers (aged 50-59)[20].

Focus on Burnout

While burnout has yet to be fully recognized as a mental illness, it has been recognized as a chronic process of exhaustion, cynicism and inefficacy caused by an imbalance between key job demands and one's ability to recover both at and outside of work[21].

Imbalances can occur in 6 main areas[22]:
1. Workload
2. Autonomy/Control
3. Reward/Recognition
4. Community (Sense of belonging)
5. Fairness (Equality of access to opportunities)
6. Values (Mismatch between company and personal values)

Imbalance in any one of these fields is associated with a greater likelihood of developing burnout. Burnout is not only about the workload itself but also about an employee's environment and management. The World Health Organization classified burnout as a clinical syndrome brought on by chronic workplace stress in May 2019. This may be the first step before it is fully recognized as an occupational and work-related disease.

Multiple socio-economic causes lie behind this growing syndrome:

• The emergence of the gig economy: many workers turn to accumulating stressful and poorly paid jobs for additional income.

• Lack of purpose: with the transformation of activities into service professions, an increasing number of employees are losing sight of the role they play in society[23].

• Job polarization: the digital transformation of companies is polarizing the labor force between unskilled manual positions full of daunting tasks and highly skilled more fulfilling jobs[24].

• The 'hustle culture': for many of the 582 million entrepreneurs worldwide[25], working for long hours has become a badge of honor, even if this means living unpredictable lives, wrestling with higher instances of issues such as anxiety[26].

The stigma surrounding burnout is gradually weakening and its prevalence is now reported in all areas of society. Burnout is so widespread that it could cost an additional $190 billion to health care systems every year[27]. The German Ministry of Labor estimated the cost of work-related stress to be between €8 to €10 billion. In Japan, the term 'karoshi' describes burnout that leads to the death of an employee. The Japanese government has made it mandatory for companies to compensate families whose loved ones have been victims of karoshi. Burnout is also a growing concern in developing countries[28] such as Mexico, where a three-year collaboration with the ILO trained trade unions to raise awareness among workers about the syndrome's prevalence.

Dementia: dealing with 150 million patients by 2050

Key takeaways:

1. In the coming years the number of dementia cases will rise as the population ages.

2. This disease entails high costs and is a heavy burden for caregivers who remain poorly trained.

3. Research is identifying new avenues, such as video games and virtual reality, to improve diagnosis and care.

Every 3 seconds, somewhere in the world, a patient is diagnosed with dementia[29] symptoms (memory loss, disorientation, erratic behaviors, difficulties with everyday tasks and language consistency), Alzheimer's disease[30] being the most common cause. Worldwide, this translates into almost 10 million new cases a year, amounting to more than 50 million affected patients today.

Dementia and ageing

Around 152 million people are expected to suffer from some form of dementia in 2050, with 68% of those in low- and middle-income countries[31]. Indeed, with the elderly populations (over the age of 60) of China (487 million), India (340 million) and Brazil (68 million), reaching altogether almost 900 million in 2050, a significant proportion of them will be at risk of dementia[32].

A widespread syndrome that affects memory, cognitive and physical capacities, dementia can often occur before the age of 65[33].

Today, a large proportion of dementia patients are either improperly diagnosed or not at all.

First, in the case of Alzheimer's disease, presence in the brain occurs a decade before the first symptoms start to show. In spite of this, there is a blatant lack of training of health care professionals to detect early symptoms. Developing diagnostic standards and training qualified staff are two of the main challenges in the coming years to better detect this silent disease[34].

Second, the negative perception of dementia drives both patients and their loved ones toward denial and withdrawal. Dementia remains a rather unspoken and stigmatizing topic, and this denial can go as far as refusing to consult a doctor or acknowledge the diagnosis[35]. According to a Singaporean study, 80,2% of people feel uncomfortable with dementia and do not wish to know its diagnosis, 67,2% wouldn't want to carry on advanced care if diagnosed, and up to 37,7% would feel ashamed and want to hide their condition if diagnosed with dementia.

The social cost of dementia

According to the WHO, the annual cost of dementia is expected to more than double to $2 trillion by 2030, up from $818 billion in 2015. This cost represents a major challenge for national health care systems, while the burden of highly demanding care for dementia patients often falls heavily on undertrained caregivers, who find it difficult to keep a full-time job while caring for a loved one, resulting in a higher risk of economic instability. As a consequence, professional and family caregivers experience a significant increase in the risk of burnout, depression and the development of psychiatric pathologies.

Preparing the future, today

To rise to the challenge of dementia care, innovative solutions in diagnosis, treatment and prevention are being developed:

• USC Information Sciences Institute researchers are working with AI and machine learning to analyze biomarkers and detect early signs of dementia.

• Health care players such as Alzheimer's Research UK are partnering with video game producers to create new types of treatment combining games and VR[36]. AXA Hong Kong is also studying VR medical applications and launched Asia's first VR psychological programme in partnership with Oxford VR and the Chinese University of Hong Kong (CUHK).

• One biotech company, United Neuroscience, is conducting advanced trials of a vaccine targeting brain proteins that could prevent and cure dementia.

• Many recent studies have pointed to external risk drivers such as physical inactivity, imbalanced diets, diabetes or depression.

$2 trillion

This is the annual estimated cost of dementia by 2030
(source: WHO)

Focus on the future of DSM-5

The Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5) is the fifth edition of a psychiatric standard supporting mind health professionals in diagnosing disorders. The first edition was published in 1952 by the American Psychiatric Association to classify mental diseases in the wake of the trauma of the Second World War. Over time, there have been five updated editions integrating the latest scientific and public findings. The way mental disorders are classified (importance, typology, treatment) reflects society's vision of mind health and is likely to evolve with greater understanding of mind health.

Evolution of DSM-5	Objectives	Methods of redaction	Methods of diagnosis	Scope for definition of mental disorders	Public attitudes toward mental illness
Previous versions of DSM-5 (from 1952 to 2013)	Help professionals with no training in mental health care to provide a diagnosis	An initiative of the American Psychiatric Association	Focused on external factors (Freudian influence on the study of the environment) rather than internal factors (psychic reactions)	Various diseases according to age, gender, environment and no consideration of lifespan disorders	Biological research but social denial: e.g. homosexuality remains a mental illness until 1974
DSM-5 (2013)	Better describe less-known disorders and qualify the symptoms more gradually, e.g. autism goes from 5 existing disorders to a specific disorder of one continiuum	• Worldwide authorship and stronger association with the WHO classification (the ICD-10) • This edition took into account feminist criticism of the previous versions	Thanks to the progress of medical imaging, includes biomarkers to measure health and "zones of rarity" (any condition defined neither as a disease nor as a normal healthy state)	Considers new disorders: • Neurodevelopmental disorders: lifelong and are not constrained by age • Use disorders: e.g. addictions to caffeine or gambling	Political decisions enable the evolution of social progress and understanding (LGBTQ rights, child protection…)
The future of mental health classicification (going forward)	Make DSM accessible to more practitioners, especially for low-resource mental health professionals and medical centers	• Inclusion of major stakeholders (e.g. policy-makers, pharmaceuticals) will provide a more open methodology • Algorithms expected to test the reliability of the classification	New technological methods: • Use of data to detect, monitor and prevent disorders • Use of AI for decision- making (e.g. choosing treatment)	Identification of new disorders linked with technology and new lifestyles (i.e. orthosomnia, orthorexia, screen use) might lead to the hyper-medicalization of normal conditions	More awareness of mental illness leading to more tolerant public attitudes towards mental disorders and that encourages well-being

Toward tech-driven solutions

How can data support diagnosis and treatment?

Technology has yet to bring major disruptions to mind health as it has for other data-driven chronic conditions, such as diabetes. Technological developments nonetheless promise to change the way mind health is both diagnosed and treated.

New technologies provide the means to collect more data to perfect the quality of diagnoses, treatments and follow-ups. With its ability to sort millions of cases, Artificial Intelligence is an unquestionable asset supporting practitioners' diagnoses and prescriptions. Furthermore, the increasing use of apps, connected devices and wearables is generating new data sources as well as providing tailor-made solutions.

To boost employees' overall well-being and productivity in the workplace, companies are also looking into sizing up behaviors through data and offering new tech-based solutions ranging from advice platforms to coaching.

When it comes to mind health, however, the two main challenges such technology faces are heterogeneity and privacy. Heterogeneity skews data towards culturally-biased results, and the data-collection "race" can lead to potentially intrusive techniques.

Focus on a Tech-Driven Market

The growing interest in mental well-being is reflected in the demand for new solutions that go beyond medication. The supply side of the market is particularly dynamic and tech-driven-through apps and connected devices. Health regulators' approval will therefore be instrumental in driving this market's future development.

A worldwide market

The global behavioural health market is expected to grow to at least US$ 156.3B by 2028 and market growth is estimated at around 3.4% CAGR from 2018 to 2028[37].

The US leads the global market, while it is nascent in Europe – led by the UK and France – and in Asia – with initiatives in Japan and Hong-Kong.

Mind health market characterization

Mind health app-based solutions offer a wealth of resources that make therapeutic techniques more accessible, portable and less expensive, or even free. The "mental-tech" market provides both patients and practioners with customized tools. It can be segmented into 6 main categories :[38][39]

• **Self-help Interactive Computer Therapy:** These are mainly user-friendly apps – such as Headspace or Calm. Such programs guide users through cognitive behavioural therapy over a course of a few weeks. These solutions cater to individuals or employers providing their employees with health care support.

• **Telemedicine / Telepsychiatry:** This applies telemedicine to the field of psychiatry. Through a digital interface, patients are treated by their psychiatrists wherever they may be. Telepsychiatry can be used by individuals or be made available by companies for their employees, with the added benefit of a rise in employees' productivity (ex: Talkspace).

• **Tool Providers:** They provide practitioners with tools that facilitate access to personalized care and enable virtual collaboration between care providers. Their customers are psychiatrists, therapists, psychologists and group practice providers.

• **Consumer Tools:** These non-therapeutic mobile apps are day-to-day assistants that provide users with recreational challenges to encourage them to achieve personal goals – as Remente does.

• **Hardware:** Through connected devices, VR, and digital health platforms, these providers develop innovative solutions to assist doctors and support them in explaining their diagnoses to patients.

• **Applied AI:** These are diverse AI-based solutions designed to deliver better mind health support. These are principally developed for professional therapeutic use, although some tools may mutually benefit practitioners and patients.

Regulatory bodies' role will grow

Tech companies strive to provide direct access to specialized practitioners. Regulatory authorities can foster these initiatives by gradually giving apps or new therapy solutions their seal of approval. This is strategic for two reasons. Firstly, the mind health market is promising but highly competitive. Secondly, any validated apps will thus evolve into "medical devices" and no longer be regarded as simple "gadgets". Regulators' seal will constitute the first step in getting reimbursed by health insurance and make these apps more attractive to future users. In fact, there are already a few examples of FDA-approved or EU-regulator-approved apps.

• As mentioned in the FemTech trend (p.30-31), two apps have been approved - Natural Cycles[40]: an app dedicated to risks during pregnancy, and Ava, an app for stress prevention.

• Cognoa was awarded the FDA's "breakthrough device" designation in 2019, for its diagnostic and therapeutic devices intended for autism spectrum disorder[41].

• The FDA also provides an overall list of devices, software and functions – including mobile apps – that they consider to be medical devices[42].

A promising but challenging market

Untreated mind health problems account for 13% of the total Global Burden of Diseases (GBD), so investments in mind health have become a priority for governments and NGOs[43]. Venture capital funding almost tripled in health tech deals in just one year, reaching US$ 793M in 2018 (v. US$ 322M in 2017). The FAMGA tech giants (Facebook, Apple, Microsoft, Google, & Amazon) also increasingly funds health tech start-ups like Gliimpse, Senosis or Pillpack. However, tech-health solutions are sometimes cited as a source of new anxiety disorders.

"The greater use of new and existing technologies in this space requires policy-makers and practitioners to navigate a complex web of ethical dilemmas, particularly in areas such as data privacy and individuals' rights "

World Economic Forum, Empowering 8 Billion Minds (2019)

Artificial Intelligence for mind health care

Key takeaways:

1. A lack of awareness, social stigma, heterogeneity of patient data and treatment efficiency make diagnosing mental illnesses early difficult.

2. AI could spur a major disruption in healthcare, to the benefit of both practitioners and patients.

3. Despite challenges specific to the field of mental health, AI solutions built on new datasets could gather more accurate patient profile information.

AI has broken into the traditional medical field, such as in imagery diagnosis or hospital management, but the emergence of data-based technology into mental health care has been slow. AI could represent a genuine asset for care systems, but it faces many challenges.

The potential of AI in health care

AI systems have the ability to learn from a large volume of data combinations sourced from imaging, genomics, and medical records; it then uses the results to assist medical professionals in diagnoses and treatments[44]. The health care AI market is forecast to grow from $600 million in 2014 to $6.6 billion in 2021[45] as automated technologies perform administrative and clinical functions that bolster human productivity.

With public policies promoting initiatives such as the French Health-Data-Hub, access to health data is increasing and data-based services for health care are flourishing. In parallel, new non-traditional sources of well-being data such as wearables, device-generated phenotypes from smartphones and behavioral data from social media or video games will feed medical datasets.

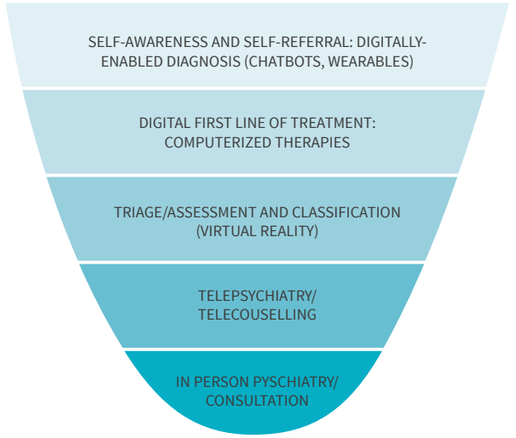
AI trends and opportunities for health care

AI tools can assist the healthcare system as a whole.

• AI is entering hospitals and care systems to better track and anticipate comprehensive care for patients. In the United States, the Cleveland Clinic uses AI to find genomic biomarkers to predict whether patients respond to a particular treatment, while University of Maryland Medical System has developed machine learning models to better predict patient readmissions.

• AI provides support for mental health professionals by facilitating earlier detection of illnesses through suggestion and prediction mechanisms. AI systems can contribute to more accurate detection and reduce medical errors. Moreover, they reduce the time doctors spend analyzing results, thus allowing them to focus on developing patient relationships and improving patient anxiety management.

• For patients who fear the social stigma of seeing a therapist, AI-based devices and technologies facilitate introduction to therapy: messaging apps that alert or advise users on their current state of mind can be used as preventive tools. A growing number of solutions designed to improve and warn individuals about their mental conditions are already on the market, such as Woebot chatbot or the AI algorithm from the World Well-Being Project; both analyze linguistic cues and language markers to diagnose depression by spotting micro-symptoms[46].



THE FUTURE PATIENT JOURNEY ACROSS THE MENTAL HEALTH CARE CONTINUUM

From self-awareness digital tools to traditional in-person counselling, this diagram shows how technological advances could empower individuals and renew the path across the mental health care continuum in the future. For many people, self-care technology can support this empowerment by providing early-level diagnosis and can lead consultation with a mental health specialist for the rarer severe cases. (This diagram was designed with the help of Dr Yi Mien Koh and Dr Matthew Patrick)

Challenges for AI in mind health

In spite of the potential to assist with mental health diagnosis and treatment, mental health data collection faces a number of challenges:

• **Privacy:** The sensitive nature of mental health data evokes access and privacy issues. Moreover, in the case of early diagnosis, which would be the most relevant area for AI development, the lack of awareness[47] associated with mental health makes it difficult for patients to acknowledge their symptoms and their need to see a professional, which reduces the scope of data collection[48].

• **Bias:** Mental health care assessment is based on a strong human dimension, more than in other conditions, making it sensitive to cultural bias. This can result in major differences in diagnosis and treatment due to the influence of the practitioner's personal experience and past education[49].

• **Un-coded data:** Most psychiatric professionals write down their therapy experience with patients, essentially recounting a human relationship. This narrative and written text un-coded data and thus hard to include effectively in AI systems.

Tracking well-being at work

Key takeaways:

1. Well-being at work is getting more attention as organizations embrace the responsibility of providing their employees with mental health support.

2. Digital solutions include preventive actions, insurance schemes and upskilling.

3. Data and technology offer new strategies to hiring organizations but could raise privacy concerns.

43%

of EU employees say they endure "uncomfortable" working conditions
(source: European Commission)

Social stigma around mind health prevents well-being from becoming a central focus in the workplace. The significant rise of work-related cases of depression since the 2000's and its repercussions have been at the heart of numerous studies that emphasize the importance of well-being at work. In the future, a number of innovations could help organizations acknowledge and respond to the mind health needs of their employees.

Mind health at work: no longer a secret

Employees report a fear of discrimination and other repercussions for openly talking about their mental conditions. Confirming this, a study shows that 69% of managers find depression not to be a serious enough condition to warrant employees taking time off [50].

Yet 43% of EU employees say they endure "uncomfortable" working conditions[51], such as poor communication, inflexible working hours, and unclear tasks. This increase the risk of mental illness, particularly in safety-sensitive positions, i.e. positions like civil aviation, where workers are responsible for the safety of others.

Employee well-being is becoming increasingly important, especially in mature economies where societal expectations are high[52]. Beyond new management approaches, such as increased horizontality, leisure facilities in the workplace and inclusion policies, technological progress also promises to foster the promotion of mind health in the workplace.

Tech-based benefits

Mind health prevention and solutions tools are expected to be included in employee benefits companies provide. Such corporate HR tools can be used as a strategy to attract talent and increase competitiveness[53].

Organizations will increasingly provide well-being platforms for various services that support mind health:

• Tailor-made insurance plans and well-being support: some insurance plans incentivize people to be healthier by offering financial rewards through a point system such as that developed by the insurance company Discovery[54]. Such programs could easily add mind health within existing modules.

• Coaching, telemedicine and chatbots: thanks to progress in neuroscience, AI-based platforms will be able to adapt to users' cognitive profiles and provide tailored caregiving service.

Organizations are now more than ever being solicited to subsidize employee subscriptions to mindfulness programs & apps or to purchase well-being wearables – rather than the old-fashioned gym membership. Major corporations such as Google and Goldman Sachs offer meditation classes to their employees[55].

New behavioral data for managers

With workplace digitalization, important sources of data are now produced while working. Digital phenotype studies assess people's well-being based on their interactions with devices such as smartphones or computers[56]. In other words, data produced by digital tools can prove to be good proxies or even predictors of employees' mind health. The Mindstrong Health platform, for example, measures people's emotional health based on how they type, tap and scroll on their phone[57]. Data is then analyzed through machine learning to detect diseases. Organizations might be interested in getting feedback on their management procedures or proactively managing employee workload and, if necessary, adjusting work schedules. AI systems could decide when it is appropriate to send email notifications or to set meetings depending on an employee's level of stress or ability to concentrate.

The limits of knowledge

These technologies would necessarily need to meet the right balance between privacy and well-being, to prevent managers from knowing too much while creating an environment of distrust for employees. A recent survey[58] suggests that 45% of employees are comfortable with sharing information if it improves employee health and well-being strategies[59].

Femtech: a new market

Key takeaways:

1. There is strong gender-specific prevalence in mental disorders; Femtech aims to address those commonly found in women.

2. Pregnancy and the first year after birth are critical periods for women. Femtech can help identify and address mental health issues quickly.

3. Femtech initiatives are receiving increasing recognition from regulatory agencies and have the potential to be central to making care more accessible and affordable.

Women play an active role in providing for their own care and act as primary caregivers, especially for the elderly and children[60]. From a market perspective, new technology suppliers are favored by a consistent demand and scalability which also leads women to benefit from considerable reductions in health costs.

With a market potential of $50 billion by 2025[61], Femtech (Female Technology) is hailed as the next big phenomenon in women's health. Femtech can be defined as a category of products, software, apps and services that use technology to improve women's lives, well-being and health.

Is mind health gendered?

While most Femtech applications revolve around women's foremost medical concerns, namely fertility, menstruation and pregnancy, digital wellness services are also gaining traction.

When comparing the prevalence of mind health disorders between men and women, figures show that depression, anxiety, eating and bipolar disorders are, on average, more prevalent among women, while schizophrenia and drug use disorders typically tend to be more common in men.

Here is a comparison of disorders more prevalent in women than men[62]:
- Depression: 4.1% vs 2.7%
- Anxiety: 4.7% vs 2.7%
- Eating: 0.29% vs 0.13%

For women, some conditions can be triggered by childbirth, early motherhood[63] and by the "double burden" of unpaid domestic labor[64]. In the United Kingdom, as many as one in five women experience mind health issues during pregnancy or in the first year after giving birth[65]. This can range from feeling anxious, moody, or depressed to having body-image issues and eating disorders or even psychosis and suicidal tendencies. If perinatal mind health issues are identified and addressed quickly, often-serious human and economic consequences can be mitigated. Femtech has the power to disrupt the women's health market and to capitalize on women's increasing use of digital health-care tools[66].

Leveraging humans and tech to promote well-being

Femtech allows even more personalization in medicine by gathering personal information such as stress level, mood or physical activity in real time. With this data, applications can then design tailor-made health recommendations and predictions. Juno Health, a behavioral health start-up, is building a platform to support and treat a variety of mind health issues by promoting online therapy and providing on-demand access to a network of mind health experts via remote consultations, text-messages or video. It is no surprise that some patients are more inclined to communicate digitally than face-to-face due to the social stigma associated with mind health. Beyond broadening access and providing more personalized features, technology can encourage users to share their experiences in a safe space, thus strengthening ties among users and reducing social stigma.

While the effectiveness of mind-health applications is still in question[67], regulatory authorities are gradually recognizing digital applications as forms of medicine. Natural Cycles, a non-hormonal birth control app, has obtained a "CE" mark, the approved class-two medical device stamp in Europe. In the United States, the AVA fertility tracker, one of the leading solutions for tracking a woman's cycle and health, is an FDA-registered device.

Data gathering techniques, user interfaces, and government approval are paving the way for Femtech in the mainstream health market.

"Some conditions can be triggered by child birth, early motherhood and by the "double burden" of unpaid domestic labor"

DESIGN FICTION BY ISCOM

Axel: the vocal assistant fighting eating disorders

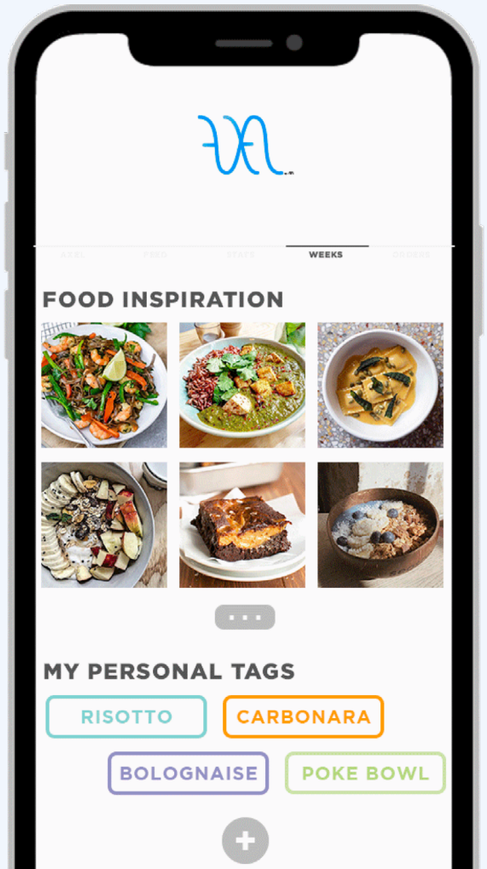
Anorexia was the first eating disorder to be recognized in the 1952 DSM-1. In the 2013 DSM-5, there are 8 eating disorders, including rumination and binge eating (see p.18). While the role of fashion and media images with extremely thin models has long been criticized, social networks are now being singled out for their influence. Instagram is particularly under the spotlight, as food-related content flourishes and engenders eating disorders among the adolescent and young adult populations[68].

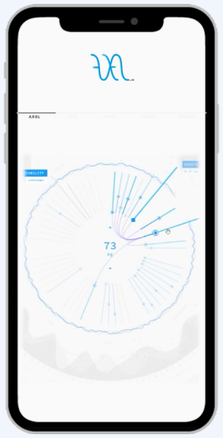
For this purpose, ISCOM students imagined Axel, a vocal assistant, to protect these susceptible segments. If it became a reality, this fictional vocal assistant would act preventively, deterring people from having negative feelings around their eating habits.

1. A care-giver

Axel helps eliminate harmful eating-behavior feeds from your Instagram: It suggests unsubscribing from negative feeds to follow more positive ones with like-minded people sharing guilt-free food-related content.

Axel will detect your emotions and react accordingly.





2. A coach

Axel coaches you, continually proposing alternatives for your nutritional and mental well-being. Axel accompanies you in your daily life, fostering overall well-being: updating your daily statistics, providing you with tailored recipes and ingredients for your health profile and reminding you to keep your diet and food plan in mind.

3. A daily assistant

Axel makes your daily life easier and frees you from tedious tasks. Axel pre-fills your shopping list based on your profile, selects the best products for you, and even orders your food.

WHY THIS MATTERS?

• 16 million people, or 0.2% of the world's population, suffer from eating disorders, with women outnumbering men two-to-one (0.29% vs 0.13%).

• Other eating disorders, yet to be recognized in the DSM, are on the radar: orthorexia – an obsession with eating healthy food and systematically rejecting "unhealthy" food, drunkorexia – saving calories from food to drink more alcohol, and pregorexia – pregnant women having an excessive fear of gaining weight during pregnancy.

CHAPTER 3 – ENVIRONMENT

Environment: the root of new disorders

How does the environment generate mental disorders?

Future generations will have to deal with the consequences of a new environmental landscape.

Although climate change is an issue on everyone's radar, the challenges of this subject are incredibly complex and go far beyond a single issue. Among these challenges figure our future living conditions, owing to the intensification of urbanization, global migration and conflicts, public policies and food production methods.

Meanwhile, scientific progress continues to call attention to an increasing number of new threats to human health, namely with regards to the food industry and our food consumption habits. Taking stock of these multiple challenges and their health impact helps build a more holistic approach to health, to reconnecting the mind and the body and to acknowledging the far-reaching effects of their interactions with environmental factors as a whole.

The premonition of a climate change crisis, coupled with the occurrence of real environmental disasters further engenders feelings of anxiety and tensions, bringing about forms of "eco-anxiety", which affect overall well-being.

New therapies

Up to now, mental illness has usually been treated with drug prescriptions. The rising controversy over the predominance of drug use, combined with significant progress in the neurosciences, has led to exploring new ways of treating mental disorders. New forms of therapies range from classical exploration of the positive role of emotions to the rising trend of reconnection to nature and the introduction of technology in treatments. Though some of these therapies may provide initial scientific evidence, others are still too novel to be convincing.

Ecotherapy (or nature therapy)

Ecotherapy is a personal development therapy promoting the restorative effects of nature. It is dedicated to people living in difficult and stressful environments. The nature-based activities range from[69]: adventure therapies (strenuous exercise such as rafting or climbing to build confidence) to animal-assisted therapies, green gyms or even the Japanese shirin-yoku – a therapy promoting the positive effects of contact with trees. Ecotherapy can improve relaxation and immune function recovery responses[70]. It has evidence-based consequences on well-being as it fosters physical activity, social interactions and contact with nature.

Sensory-based therapies

Therapies stimulating the senses have long been used for healing. Light therapy (or phototherapy), for example, has been used since ancient times to treat depression. It consists of exposure to specific wavelengths of light and is prescribed for several mental conditions such as depression, dementia or seasonal affective disorder. Other therapies that deprive the senses are emerging, such as Restricted Environmental Stimulation Therapies (REST), techniques that offer isolation and floating tanks. Darkness, silence and floating free the human brain from external stimuli and enable full relaxation, comparable to meditation.

Community therapies

Community therapies are group-based rehabilitation-building solutions for patients. These communities enable patients to find their own answers to overcoming their illness through a supportive, caring group comprised of patients and resident therapists. More specifically, in a CRAFT (Community Reinforcement and Family Training) therapy, family and friends are taught effective strategies to help their loved ones reduce their disorder through a positive, motivational therapy, rather than a confrontational approach.

Virtual Reality (VR) therapy

Virtual reality therapy exposes people with anxieties, social disorders or phobias to their fears[71]. VR simulates a virtual world to generate real world emotions so that patients react spontaneously and learn from the situation to overcome their obstacles. The mind and the body behave as if the simulated environment were real. People with paranoid schizophrenia can experience a café full of strangers through VR to overcome their fear. VR can reduce PTSD[72] and patients' fear and avoidance of social situations. The exposure is progressively graded by a therapist who interacts and coaches the patients. Other solutions such as Oxford VR are automated, using a virtual coach for therapy, with significant impact on patients[73] and at lower cost for health providers.

Art therapy

Art therapies[74] exploit patients' creativity to enable them to express themselves. They undertake to improve deficiencies in cognition, self-esteem, emotional resilience or social skills. With the guidance of a certified art therapist, patients can learn to use their art production to resolve deeper hidden issues. Music therapy, is for instance, the interpersonal process in which a therapist uses music in all of its facets (playing, teaching…) to help patients improve their health[75]. Music has been proven to relieve anxiety or pain. The emotion, cognition and communication features of music also enhance non-verbal communication, which helps patients with autism or dementia. According to research in the field of positive psychology[76], when coupled with traditional therapy, art therapy has succeeded in treating patients with mental health problems, learning difficulties, dementia and autism.

Climate change and pre-traumatic stress disorder

Key takeaways:

1. Climate change can impact both physical and mental well-being.

2. Eco-anxiety, green guilt and solastalgia are forms of emerging mental distress triggered by the perception of climate evolution and its implications on direct environmental structures.

3. A rise in natural disasters could result in a higher incidence of acute mental disorders.

68%

of the world's population considers climate change as a major threat
(source: Pew Research Center)

In 2019, 68% of the world's population considered climate change as a major threat[77]. Many feel helpless and even desperate about the vision of an irremediable destruction of the environment and its consequences for their future and that of following generations. This has been termed "eco-anxiety".

When concerns about climate change turn into eco-anxiety

Restlessness, fatigue, difficulty concentrating, irritability, muscle tension and sleep disturbances: these are the anxiety-like symptoms affecting a growing number of people concerned about climate-change issues. This explains the spread of terms referring to anxiety generated by deep environmental concerns such as eco-anxiety. While it has been recognized by the American Psychology Association[78] and has been the subject of various dedicated publications, eco-anxiety is, for now, not medically considered as a mental disorder *per se*.

Unlike "traditional ecological worrying" linked to pro-environmental attitudes, eco-anxiety is not specific to environmental activists. Looking at the figures on climate change perception, American (both North, Central and South), African and West European populations seem to feel more concerned, compared to people in Asian and Middle Eastern countries[79]. In countries where polls were conducted on eco-anxiety, results show that young people are particularly affected (e.g. 40% of 16-24-year old in the United Kingdom compared to 29% in the overall population[80]).

What is the origin of eco-anxiety?

Climate change can be considered as a hybrid risk, an "ongoing threat or event perceived or understood as reflecting both natural and human causes and processes[81]." People may therefore paradoxically feel helpless yet responsible for climate change. "Eco-guilt" or "green guilt", that is, guilt for not doing enough to preserve the environment or for acting in a way that has no beneficial impact on the environment, is the psychological fallout of speeches calling for individual actions to tackle climate change.

Intense and tragic media coverage of climate change and natural disasters has also been identified as increasing these feelings[82]. The democratization of climate-fiction (the depiction of post-apocalyptic societies where the environment has been destroyed in literary or cinematographic works) and the rise of "collapsology" theories might also exacerbate this phenomenon.

Guilt and fear can trigger psychological denial, a "defense mechanism in which the existence of unpleasant internal or external realities is denied and kept out of conscious awareness" to lower one's anxiety. Quite on the contrary, psychologists advocate taking concrete actions both at an individual and community level to tackle eco-anxiety.

Changing environment: from post-traumatic stress disorders to "solastalgia"

Eco-anxiety derives from the uncertainty and unknowns around climate change and its effects; it can therefore be regarded as an indirect psychological impact of climate change. This anxiety can be defined as a "pre-traumatic" stress disorder, but when extreme weather disasters occur, the effects on mind health are well documented and are close to post-traumatic stress disorders, particularly for children, and they last for several years. In the long run, 7% to 40% of victims suffer from psychopathologies such as general anxiety, phobias, addictions and depression[83]. Well-being and mind health will also be impacted at a psychosocial level, as devastation from natural disasters endangers social cohesion. At the community level, loss of social status can lead to violence whereas, at a larger scale, displacements of populations can bring about ethnic tensions[84]. This will mainly be an issue in emerging countries; they registered 95% of the total death toll from natural disasters in the period from 1970 to 2008[85].

Similar to the "ecological grief, the physiological and emotional response to loss experienced by Arctic communities[86], solastalgia might become this century's new evil. Solastalgia is "the distress environmental change produces when it directly alters one's immediate 'home' environment[87]". This neologism sums up the devasting effects of the anguish caused by environmental alterations and catastrophes. Whereas nostalgia is experienced when people are away from home, solastalgia is 'feeling homesick when people are home'. This can erode land-based traditions and increase ethnic vulnerability[88].

Toward well-being-by-design cities

Key takeaways:

1. Tackling the effects of pollution and its impact on mental health will be a major challenge for cities worldwide.

2. Urban planning will be leveraged to integrate well-being through design.

3. Cities will strive to increase social cohesion to reduce mental health disorders.

1 in 5

European inhabitants are exposed to sound levels endangering their health
(source: WHO)

By 2050, 68% of the population will live in urban areas, particularly in Africa and Asia (90% of the urban population growth). By 2030, 43 megacities (over 10 million inhabitants) are expected to be built, most of these in emerging countries[89], and 60% of all city inhabitants could be under 18[90]. As urban physical and socio environments decisively influence mind health and well-being[91], it is becoming paramount to involve cities in addressing these issues.

Is the urban environment conducive to mind health?

Inhabitants of urban areas seem to suffer more from certain mental illnesses (psychotic disorders, anxiety[92] and schizophrenia[93]) than inhabitants of rural areas. One explanation may lie in cities' poorer environmental conditions due to air, noise and light pollution.

Air pollution impacts our mind health and well-being[94]. Research indicates that air pollution from microparticle contamination, primarily due to road traffic, may lead to a 17% increase in mental distress[95] and be another risk factor of suicide[96] and depression[97]. This is particularly true for children, as exposure to microparticles can be correlated with a 12-15%[98] increase in autistic disorders and disturb the cognitive development[99]. These challenges will become particularly significant in emerging countries where the most polluted cities are located, notably in Asia[100].

Noise pollution also has a significant negative impact on health. According to the WHO[101], 1/5 of European inhabitants are exposed to sound levels that endanger their health. Beyond noise from transportation, inhabitants are subject to turbine and leisure noise and children are, again, particularly affected. Noise pollution can increase children's hyperactivity/inattention symptoms[102], while light pollution can indirectly increase mental disorders by damaging sleep[103].

Cities turning green and walkable

Traditionally, to tackle mind health issues at a local level, city authorities mainly focused on infrastructure – access to health centers, transport, and utilities. There has been a renewed interest in "urban green", places with natural settings started by the UK garden city movement in the 1890s, and in "blue areas", with water elements for their impact on well-being and mind health, since the 2000. Indeed, having access to green and blue areas positively affects mind health and well-being by reducing stress, encouraging physical activity, fostering greater social cohesion, and cutting down on air and noise pollution[104]. Singapore has played a pioneering role with its Gardens by the Bay, which were part of its national strategy to move from a "Garden City" to a "City in a Garden".

Developing walkable areas is another approach considered by several cities with "car-free days" (e.g. Kigali, Rwanda) or even "car-free weeks" (e.g. Bogota, Colombia). Digital solutions are also emerging: the Walkscore app allows users to compare cities and neighborhoods in the United States, Canada and Australia based on their walkability, and the Walkonomics app provides walkers with greener ways to their destinations.

Building inclusive cities

Cities have so far mainly focused on how environmental factors influence mind health, but other avenues are likely to be explored in the future:

First of all, cities will become "conscious" or "psychology-based". Whereas urban planners have tended to focus mainly on functionality, they will take psychology and neuroscience findings into account to build cities that foster well-being. Facade features and colors, lighting, and urban furniture will all be chosen for their positive influence.

Cities may also play a role in improving social cohesion and reducing isolation, another major factor in preventing mental disorders[105]. The city of Milan was awarded "Well-being City 2019" for its "Civic Crowdfunding" that favors citizen participation. Some consider that "socially/inclusive smart cities" can be built to boost citizens' participation (i.e. the b-citi platform to better connect cities to its citizens) and well-being. Nonetheless, some fear smart cities, by becoming "faster cities", will increase stress levels by accelerating the pace of life and increasing the use of digital services and, potentially, endangering the energy sustainability of these cities.

Monitoring well-being at a local scale will therefore become crucial. Indeed, happiness economics already provides tools to monitor well-being at a national level, but the future of urban "happiness" planning will lay in the development of tools designed at the local level. The city of Santa Monica has already based its policies on 'home-made' well-being indicators, and non-governmental organizations like Happy City in the UK are developing measurement tools tailored for local policy makers.

The impact of food on mind health

Key takeaways:

1. The impact of diet on mental health is being increasingly documented and will pave the way for new therapeutic solutions.

2. Personalized nutrition could unleash the potential of such solutions.

3. The choice of food production methods (use of chemicals, meat products, biotechnology, etc.) will not only have an impact on the environment but also on public mental health.

"Gut-brain-axis studies show that a lack of a specfic bacteria can be correlated with depression symptoms."

With 9.73 billion inhabitants in 2050, the UN's Food and Agriculture Organization estimates that global food production will have to increase by 70%. This will be a formidable challenge in the context of climate change, efforts to minimize agriculture's environmental footprint and food production constraints. A few new production methods are being considered, but their environmental and health impacts are yet to be determined.

Eating behaviors and their mind health impact

It has long been recognized that people's state of mind has an influence on their eating behavior. Conversely, there is growing evidence that food not only impacts well-being but also the prevalence of some mental illnesses (depression, Alzheimer's, etc.) through:

• **Diet:** People on a Mediterranean diet have a 33% lower risk of suffering from depression[106]. The Washoku Japanese diet may favor good mind health and prevent mental disorders[107] as a higher intake of fish may lower the risk of developing Alzheimer's Disease by 36%[108].

• **Micronutrients (vitamins and mineral required in very small amounts) and macronutrinients (carbohydrate, proteins, lipids and alcohol)[109]:** Taking omega-3 (macronutrient) reduces depressive symptoms[110]. Deficits in micronutrients such as zinc, vitamin B12, calcium, magnesium, etc. might contribute to developing mental illnesses.

• **The gut's microbiota (i.e. all the microorganisms that are present in our guts, see BeBiot design fiction p 46-47):** This impacts our well-being and mind health through the gut-brain-axis. A lack of a specific bacteria can, for example, be correlated with depression symptoms[111].

From food production to food consumption

Recognizing the impact of diet on mind health and well-being, many traditional medicines place them at the heart of their approach. In India, nutrition is one of the components of Ayurveda - the traditional Indian medicine that links body and mind in a holistic health approach. Spices are used both to flavor dishes and to contribute to mind health[112]. It is, however, only since the 2000s that modern medicine has taken a scientific interest in diets.

There is also a growing awareness of the impact of food production methods on mind health. Endocrine disruptors (i.e. exogenous substance or mixtures that alter function(s) of the endocrine system and consequently cause adverse health effects in an intact organism, or its progeny, or (sub) populations are a paramount example. As endocrine disruptors (EDs) come mainly from pesticides and plastic-derived goods, such as packaging, food is the leading ED-contamination source humans are exposed to. Since the 2000s, their proliferation in the environment, along with their life-long impact on physical and mind health, has become a major issue. For example, prenatal exposure to phthalates and bisphenol A is linked to an increase in behavioral and relationship problems and hyperactivity[113]. Legislation is likely to become stricter as the dangers of such substances are discovered.

"Let food be thy medicine and medicine be thy food" - Hippocrates

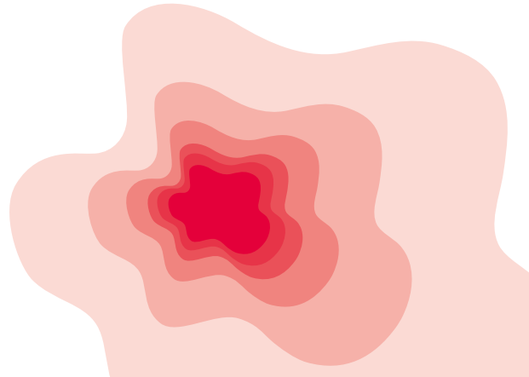
Food is increasingly seen for its role in preventing mental diseases, favoring well-being, and tackling mental disorders.

• Since 2010, "nutritional psychology" has been booming. Alongside drug solutions, eating "food for the brain" and following a certain diet such as DASH or MIND[114] could become commonplace to tackle mental disorders. (DASH diet focuses on fruits, vegetables, whole grains and lean meat, whereas MIND diet combines DASH and the Mediterranean diet). In particular, as depression and obesity seem to be highly correlated[115], changing diet habits could be a way to lower depressive symptoms[116]. This concern could grow as 57.8% of the world population (3.3 billion) could be obese by 2030.

• **Nutraceuticals[117] (Combination of "nutrition" and "pharmaceutical", fall into 2 categories:** Dietary supplements and functional food are on the rise, with a market estimated at USD 671.30 billion by 2024 and an annual growth of 7.5%[118]. In particular, agri-food industries are positioning themselves in the mind health segment (i.e. Axona, an Accera product, which was acquired by Nestlé Health Science to fight Alzheimer's disease). In this regard, probiotics are also under study[119].

Personalized nutrition is becoming feasible and will gain momentum. This echoes the emerging and cyclical concept of P4 medicine: predictive, preventive, personalized and participatory. Nutrigenetics and nutrigenomics aim to reveal potential connections between one's diet, genes and mental illnesses. For now, personalized nutrition focuses mainly on physical health (see for example Habit or Nutrigenomix), but there are a few initiatives under way to incorporate mind and well-being aspects.

To provide the world's population with nutritional food while simultaneously taking into account environmental constraints, other technologies such as Lab-grown meat[120], 3D-food printing or CRISP-R gene-modification are being considered. Many questions remain unanswered as to the safety of lab-produced food as well as its energy use, sustainability, and consumer acceptance. These solutions provide a functional approach to nutrition with the social aspects of food, cooking, eating time, and the like, set aside. Will consumers accept and be happy to eat pills for lunch?



DESIGN FICTION

BeBiot an app to manage of your microbiota to improve your well-being

Microbiota refers to all microorganisms living in a specific environment. Humans host multiple microbiotas in their body. The most important are those in the intestines, as these are vital to the digestive, metabolic, immune and neurological functions. Dysbiosis (disbalanced or impaired microbiota) could effect various neuropsychiatric diseases and might be linked to stress and depression[121]. Several therapeutic approaches exist for dysbiosis, and one of the most promising today is nutrition.

Through BeBiot, a fictional application, ISCOM students explored nutrition as therapy and imagined its massive, non-intrusive democratization in 2025. Feeling tired? In bad shape? Stressed? It may be time to check-up on your microbiota.

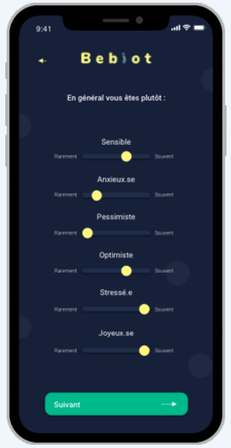
1. Improve your gut-brain axis with Bebiot

• Monitor your microbiota in real time simply by passing the sensor over your belly, rather than doing a fecal test

• View the results on your app and share it with your health-care professionals

• Benefit from personalized nutrition advice to be at your optimum

• Limit medication when depressed: proper nutrition can lessen your symptoms and your drug intake



2. Get personalized daily recommendations

Follow the daily evolution of your microbiota. A user-friendly interactive table allows you to track your history, identify painful events and see your improvements.

Track your mood and personalize your diet: benefit from personalized microbiome-based recipes and products from selected partners. Connect BeBiot to your 3D smart food printer to create and eat the right meal in one click.

3. Plan ahead to be at your optimum

Anticipate events that might affect your wellbeing: Are you going to have a stressful painful event in the coming days? Put it on your personal calendar and get personalized advice

Integrate nutrition into your overall health journey: you can share your data with your health professionals. This application has obtained the maximum “Health Data Protection” label: it allows you to choose with whom you share your data.

WHY THIS MATTERS?

• Emerging studies are exploring a fascinating correlation between gut microbiota’s composition and mental health, opening new lines of research for potential novel therapies.

CHAPTER 4 – SOCIO-ECONOMICS

Modern lifestyles: a stress on well-being

How does society define individual satisfaction?

The human brain has learned over centuries to progressively adapt to its environment. Today, however, the environment is changing at an unprecedented pace, and the brain cannot evolve at the same speed. The ever-faster pace of technological and societal evolution is challenging human minds and generating stress.

Although technologies promised global connection, depression caused by loneliness and social isolation continues to rise. New lifestyles also put pressure on overall health as widespread sleep deprivation demonstrates. These new pressures test human adaptability and question people's overall satisfaction in life. While inequalities continue to grow, reported levels of happiness are falling. In parallel, self-help methods are a growing business that can counterproductively turn the pursuit of well-being into a seemingly unattainable quest.

Drug use & mind health

Legal or illegal psychoactive substances, by definition, affect the mental state of the user. For 305 million people globally, this consumption has led to a “substance use disorder”, which, in turn, aggravates and causes other mental illnesses[122]. 50% of people diagnosed with severe mental illness are affected by substance abuse. Here is a quick focus on four drug consumption trends and their potential consequences.

From the US to a Global Opioid Crisis

Opioids are natural or synthetic addictive substances that in some cases are legal (morphine, fentanyl) and used in the treatment of post-surgical or chronic pain. The term “opioid crisis” refers to the increase in the non-medical use of opioids in North America that has generated an explosion in dependency and an eightfold increase in the number of deaths by overdose in the US[123]. While 95% of opioid consumption is currently concentrated in high-income countries[124], in the coming years the practice of misuse of these drugs could spread to other regions such as Latin America, Asia and Africa. Several emerging crises have already been identified across the world including in low- and middle-income countries[125].

Smart Drugs, the 21st century health crisis?

Pharmacological Cognitive Enhancers (PCE), also known as “smart drugs” or “nootropics”, were originally created to fight cognitive deficiencies, narcolepsy and disorders such as schizophrenia or ADHD (“Attention Deficit Hyperactivity Disorder” characterized by an ongoing pattern of inattention and/or hyperactivity). According to a 15-country study, the largest available, psychostimulants, wakefulness-promoting agents and amphetamine cocktails are now consumed by 14% of the population, the majority of whom are under 25[126]. By 2024, the “smart drug” market is set to reach USD 5,959 million[127], far exceeding medical and prescription use. A number of factors have been fuelling this rapidly growing trend: the globalization of ADHD, the trivialization of the prescription of cognitive enhancers, increased competition at universities and in the workplace, the growing “hustle culture”, and weak control and prevention policies. Yet the long-term effects of these drugs are still unknown, and their positive effects on cognition are still being questioned[128].

Legalising cannabis, an opportunity or threat?

In recent years, an increasing number of countries have started pondering whether to legalize cannabis for therapeutic or recreational use[129], as part of a global shift to reconsider the ban on marijuana[130]. In 2017, for example, Canada became the second country in the world - after Uruguay - to fully legalize recreational cannabis[131], and this trend may well spread to many more countries in the near future. In the long run, cannabis could become just as common as cigarettes or alcohol. Recently, studies are multiplying to demonstrate the effectiveness of the plant in treating a number of cancer, HIV or anorexia symptoms[132][133]. Its therapeutic applications in pain management also provide potential benefits by improving both physical and psychological well-being[134]. However, this new “green rush” should be counterbalanced with its potential public health consequences – in particular, its mental health consequences – for the effects of intensive cannabis use are still unknown.

Psychedelic Medicine

With the 2019 opening of Jamaica’s first research centre[135] dedicated to the active substance of hallucinogenic mushrooms, psilocybin, new avenues are flourishing for the treatment of anorexia[136], ADHD and depression[137]. There are many global initiatives[138] for the launch of clinical trials on a substance that may be able to treat the 300 million[139] people affected by these diseases. In September 2019, researchers succeeded in modifying a bacterium enabling its large-scale exploitation through low-cost mass production[140]. Communities currently exist where people are testing their own homemade self-treatments, potentially putting their health at stake. Research is under way, and psychedelic medicine could possibly further the treatment of mind health in the future.

When sleep deprivation wakes up depression

Key takeaways:

1. The proportion of sleep-indebted people is on the rise worldwide.

2. Sleep is what determines overall health and well-being; deprivation results in significant costs for society.

3. Innovative tools to track and manage sleep can provide better diagnosis but can also be a source of disorders.

With modern lifestyle habits, the time people dedicate to sleep is shrinking. This is giving rise to a series of potential health issues and high social costs that can range from car crashes to on-the-job mistakes.

Getting enough sleep is one of the foundations of good health, and lack of sleep is associated with an increased risk of developing chronic conditions and mental distress.

Sleep is slipping away

A 2019 study[141] reveals the French spend less time sleeping, averaging no more than 6 hours and 42 minutes a day. Up to 35.9% of the population is even sliding under 6 hours. The same holds true in the US[142], where 40% of 25 to 54-year-olds get less than the daily recommended 7 hours of sleep. This trend is equally observed from Brazil to Japan, and from Europe to Australia: the proportion of "small sleepers" is on the rise[143].

Besides typical reasons such as the surge in night-shift work, commuting time and noisy environments, people's shrinking sleep patterns are now strongly associated with their screen time. Others blame the effects of the "hustle culture"[144] [145], where sleep is considered a waste of time. Attitudes like this are fueled by high-profile "elites" who claim to get by on little sleep.

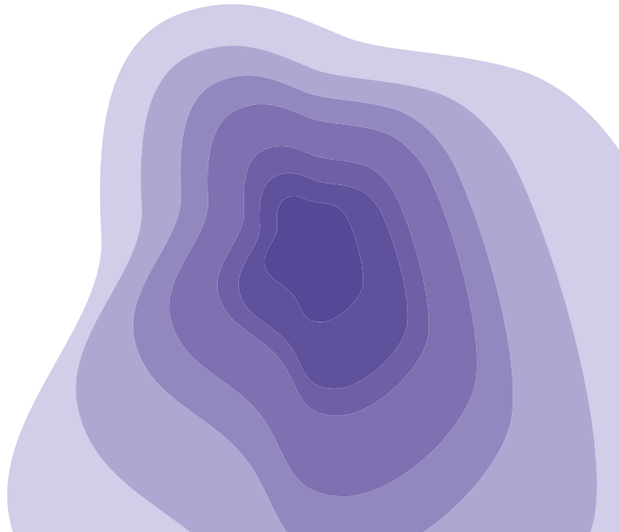
One of the new factors found to explain the decline in sleep is the use of smartphones. Indeed, from a physiological perspective, the screens' blue light hinders the secretion of melatonin, the sleep-stimulating hormone, and hence contributes to producing so-called 'social jet lag'.

Sleep is what determines overall health and well-being. Sleep deprivation is associated with many chronic diseases and conditions such as type 2 diabetes, heart disease, obesity and depression. A New York Times article put it succinctly: "The simplest way to drastically improve your life: more sleep[146]". A McKinsey study found that sleep is also part of a larger energy management challenge that could represent a significant organizational cost. Sleep is beneficial for a host of cognitive functions pivotal to decision-making as well as to the learning process. A loss in the ability to make accurate judgments, for example, is associated with sleep deprivation[147].

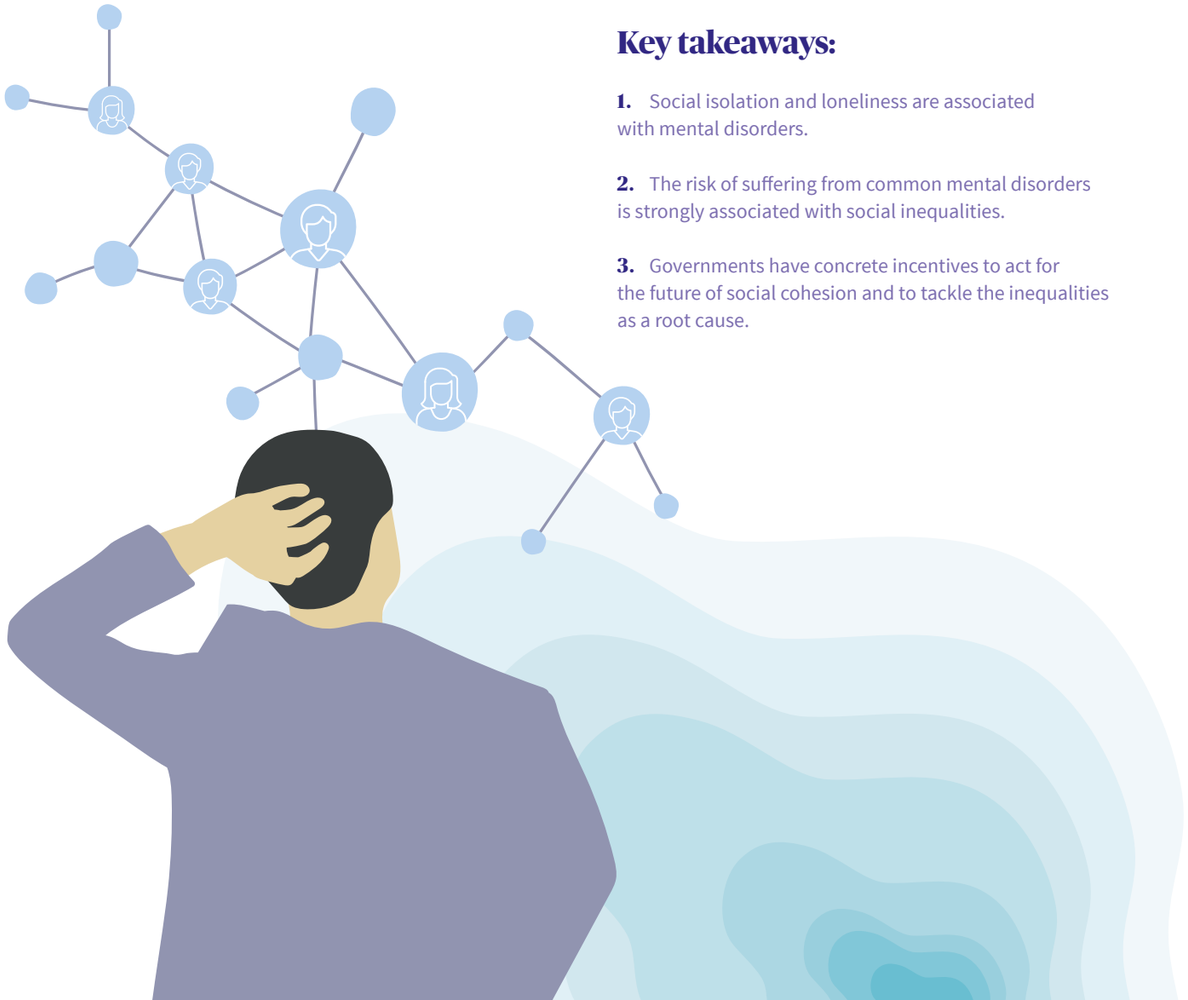
Society is recognizing the importance of sleep

While technology has helped provide better diagnoses, wristband or sleep tracking apps that encourage individuals to monitor their sleep patterns can, paradoxically, also contributed to a new behavioral disorder called orthosomnia[148]. Measuring and tracking one's sleep can turn people into perfectionists seeking an ideal night's sleep. This quest can, in itself, become a new source of anxiety. Although the causal relationship is still complex, disturbed sleep is associated with depression[149]. While sleep disturbance has long been considered a symptom of depression, recent research has indicated that depressive symptoms may decrease once sufficient sleep has been restored.

As societies become increasingly tired, companies are realizing there is a growing opportunity for innovation in this space. Inspired by cultures where napping is the norm and in order to foster virtuous behaviors, a growing number of initiatives are emerging. These range from prevention (such as the World Sleep Day[150]) to encouraging the creation of napping rooms or pods. Another radical vision of the future of sleep, such as that of transhumanists, is based on optimization where the need for sleep has to be cured just like a disease. This desire to push the limits of what is natural is also upheld by government agencies – like the American military research group DARPA, with its and the hyper-awake soldiers and other science-related projects developing ways to promote wakefulness[151].



Reconnecting people to prevent mental disorders



Key takeaways:

1. Social isolation and loneliness are associated with mental disorders.

2. The risk of suffering from common mental disorders is strongly associated with social inequalities.

3. Governments have concrete incentives to act for the future of social cohesion and to tackle the inequalities as a root cause.

Though the modern world is supposed to be increasingly open and connected, the feeling of loneliness persists. Social isolation – as a state of near or complete lack of contact between an individual and society – acts as a particularly significant catalyst in increasing the risk of mental disorders[152].

Loneliness and mind health disorders, a global phenomenon

Whatever people's financial resources may be, loneliness is gaining momentum[153]: in 2019, 31% of the global population considered loneliness as a concern, convinced it would last most of the year[154]. This is particularly true in Asia, with four of the world's most affected countries – Turkey, Saudi Arabia, China, and Malaysia.

Studies demonstrate that the more unequal societies are, the more likely they are to undergo not only a wide range of health challenges – dependence disorders, chronic diseases, self-isolation[155] – but also broader social issues – reduced life expectancy, higher infant mortality, poor educational achievement, lower social mobility and increased levels of violence[156]. Access to mind health treatment depends on a country's economic development level, so income inequalities end up perpetuating mental disorders. While 35% to 50% of severe mind-health-disorder sufferers in high-income countries receive no treatment, these numbers skyrocket to a minimum of 76% in low-income countries: social cohesion directly affects mental illness.

Mind health disorders are a worldwide phenomenon[157]. Documented cases of depressive and anxiety disorders are indeed nearly equally distributed between the 6 WHO regions.

According to the WHO's Global Health Estimates, such mental diseases can lead to suicide, (800 000 worldwide in 2016), echoing the Durkheim suicide theory and the "egoistic suicide" – a reflection of a sense of not belonging to a community. Social isolation also stems from today's deep societal changes, as these contribute to drastically diminishing human interactions. Modern work habits may involve fewer direct social interactions (NEETs[158], unemployment, teleworking and independent workers), marital instability is more prevalent[159], and single parent families are on the rise (the average OECD household size has dropped from 2.8 to 2.6 since the 1980s[160]).

Moreover, social media tends to exacerbate feelings of loneliness rather than offering new friends – for every 10% rise in negative experiences on social media, there was a 13% increase in loneliness[161]. Worse, there is no such connection for positive experiences.

Isolation walls in mind health

A number of initiatives have been launched to tackle the issue of loneliness across the world. Indeed, according to WHO, 72% of member states have a stand-alone policy or plan for mind health, and 57% have a stand-alone mind health law[162].

• In 2018, the United Kingdom appointed a "Minister of Loneliness" to incorporate social determinants of mind health.

• In New Zealand, the annual budget put social well-being indicators ahead of GDP for the first time in 2019 in order to inform spending decisions[163].

• Several countries – e.g. Australia, Iran, Japan – launched programs in the mid-2010s, to develop children's skills and aptitudes[164] [165] and to lower risks associated with poor mind health.

Shedding light on the relationship between isolation and mind health could result in future government initiatives to face this issue.

The pursuit of happiness: the new imperative?

Key takeaways:

1. Positive psychology underscores the benefits of happiness on physical and mental health, commitment to work and global life engagements.

2. Yet this new culture and its associated "happiness market" may pressure individuals.

3. The pressure for happiness could highlight inequalities and even create new ones.

"The quest to be happy might, in fact, produce the opposite with its ego-driven pressure for self-improvement"

Social scientists are starting to critically analyse the place happiness holds in our societies and the inclusiveness of such a concept.

What is happiness?

For the last 50 years, purchasing power has increased globally, the reported levels of happiness have stagnated in the West. Dismissed for a long time as a hedonistic and utilitarian philosophy[166], happiness and its significance for populations have gained attention in the public policy arena and has been on the UN agenda since the release of the annual World Happiness Report in 2011[167]. Beyond assessing the factors of health and income, this report weighs qualitative factors such as social support, generosity, level of freedom and trust in institutions. This report has also underscored a correlation between mental illness and people's overall satisfaction in life: people with mental disorders are less likely to be happy. This growing focus on happiness in the social sciences has sparked debate over whether such a personal feeling should be integrated into rankings.

A renewed attention to happiness

Traditional psychoanalysis used to focus on the negative aspects of psychology, such as depression and mental diseases, but since the 2010s, positive psychology has been on the rise. This movement studies positive experiences in social relationships and institutions. It sees happiness as an aggregation of multiple emotions, and its objective is to pinpoint what makes individuals happy to better heal them. Researchers have shown that happiness improves people's health, productivity and creativity: starting from a simple smile that could enhance healing and reduce physical pain.

From utopia to an attainable objective

The notion of happiness is spreading in a wide range of domains. It is being integrated into public policy goals as a dedicated national happiness budget (e.g. in New Zealand) and its presence in international rankings show. New employee-satisfaction-based methods of management are being put into place with the introduction of "Chief Happiness Officer" roles, in-company leisure infrastructures, and initiatives to provide employees with a sense of purpose[168]. This demonstrates to what extent personal well-being is also considered in the workplace. Some progressive schools also encourage pupils to express their feelings, while the most elite, such as Eton College, teach gratitude, which is held to be a key component of happiness.

The new culture

Happiness is also an endless market of 'emotional goods'[169]: new assessment methods, trendy diets, and experiences. When people feel less than satisfied, they may be led to believe they are "out-of-sync" and be encouraged to consume more.

Afew sociologists have written about how being happy has become an "imperative" since the 2000s and how this culture might, in fact, produce the opposite with its ego-driven pressure for self-improvement. Moreover, continuously trying to control one's feelings can be demanding for mind health and provoke greater anxiety[170].

Who is excluded from happiness?

Some people choose less demanding jobs with more spare time over higher-income demanding jobs. This demonstrates how social divides create different definitions of happiness. Indeed, those who prefer leisure to work already have the liberty to choose: they are certainly happier, but their choice may be motivated by an absence of financial constraints. Conversely, low-income earners are more likely to choose life habits that could distance them from happiness (bigger workloads, less personal activities, more household chores). Satisfaction in life still greatly ties in with income differentials and could break society down into social, racial and gender perimeters.

Moreover, happiness as a positive ideology could be used to compensate for negative circumstances such as inequalities or poverty[171]: those failing to accept their circumstances, such as protesters, could be 'pathologized'. If that were to happen, depicting part of the population as diseased could then make it all the more problematic to understand social discontents.

6 common stances on mind health and well-being

“The classification of new mind health conditions is pathologizing normal life”

Understandably so.

Some new pathologies, especially those that figure in the DSM-5, seem to fall into normality (e.g. mood disorders). Psychology is ever-present in day-to-day conversations and used to interpret self-understanding and categorize people (e.g. autism, ADHD). This has come about with the evolution of society. These pathologies are now perceived as increasingly challenging for mind health, and awareness is growing. The economic and environmental disasters the world has been experiencing for the past decade are, for instance, triggering new symptoms of despair and distress. These evolutions are reflected in mind health related classifications.

“Screens are altering mind health”

Yes, and they can also have a positive impact.

While video games are usually blamed for increasing violence and social isolation, especially among the young, there is no irrefutable evidence showing they have harmful effects. Depending on a child’s predisposition, video games could counter-intuitively have beneficial outcomes. Depending on the games, they can challenge or build up self-confidence, create team spirit, enhance brain stimulation and even strategic thinking. Surprisingly, evidence on social media’s effect on children or young people’s mind health is weak. What is clear is that individuals who are vulnerable are potentially even more so in a digital space. The next stage to explore is how to selectively take advantage of technology’s benefits without exposing weak or vulnerable individuals to its negative aspects.

“Depression and mood disorders are a high-income country problem”

Certainly not.

Even if high-income countries present more diagnoses of mental disorders, pathologies affect all of humankind, though prevalence might vary between countries. For example, high-income countries present more cases of dementia or personality disorders, but the percentage of the population suffering from depression is higher in Angola than it is in Spain or in Canada. Moreover, some developing countries are actually more exposed to some mental disorders, such as post-traumatic stress disorder, that are set off by war or violence. Furthermore, while mental health is not the priority for many developing countries, they are developing facilities and programmes to manage these conditions. Conditions favoring mental health and its treatments are global.

“Technology is more reliable than humans in diagnosing mental health”

To a certain extent.

Technology, and more specifically machine learning prediction algorithms, is now used to analyse huge data sets to improve diagnosis and reduce medical errors. In the field of mental health, the required amount of data is not fully defined and brain advancements remain limited. Some AI-based technologies are intent on interpreting human expressions: i.e. daily behavioural cues could detect depressive moods. However, the diagnosis of a mental disorder does hinge on a therapist’s subjectivity and on the human relationship with the patient, in order to spot a potential moral hazard. In addition, patients do not all perceive technologies in the same way. Whereas some who fear judgement may be more comfortable speaking to a bot, others may morally refuse to share their intimate feelings with technology.

“Pharmaceutical interests are at stake in the field of mental health”

Not surprisingly, yes.

Psychiatric medications have been used since the 1960s. They were a revolution in the treatment of mental illnesses, as they are the most “pain-free” medical solution to date. Nevertheless, it has also been demonstrated that mentally ill people are more vulnerable and likely to abuse drugs. Combination solutions exist and new drug-free therapies are emerging. Future drugs are also expected to be better targeted to patient’s profiles, with fewer side-effects. Furthermore, we can expect pharmacology in the future to promote more transparency in response to corporate responsibility initiatives in the industry.

“Collecting personal data to raise mental health awareness is inevitably intrusive”

Of course, but what if this was necessary?

Mental health data are intrinsically private and sensitive, for they touch on a person’s innermost feelings and thoughts. A new multidisciplinary field of science called digital phenotyping is emerging, where a person’s intimate feelings can be inferred based on digital devices or social media data. The way these data are collected, for what purpose and whether individuals can act on them determine the intrusiveness of such practices. Although the right to privacy in this domain is stringent, its application is of increasing concern for regulators, consumers and public opinion. Privacy is thus likely to be preserved in the future, with privacy policies and regulations enhanced.

Mind Health and Well-being: what matters to AXA?

In November 2019, the AXA Foresight Team hosted a two-day Foresight event in Milan, gathering close to 40 AXA colleagues from entities worldwide including a few pivotal Asian, Latin American and European departments that presented trends likely to shape the future of mind health and well-being. The World Café methodology was used to facilitate the workshop session. This is a structured conversational process for knowledge sharing, in which groups of people discuss a topic at different tables and create an atmosphere that encourages exchanges and brings out innovative ideas.

6 major mind health-related subjects were discussed. These ranged from specific populations such as youth, workers/employees, and corporate clients to more horizontal issues around the need for destigmatisation while promoting a more holistic approach to health to reconcile body and mind, and even the market dynamics. This workshop session made it possible to identify the future challenges society will be facing by 2030 and to collectively imagine how AXA could respond as an insurer, an employer and a societal player.

Starting from the current situation…

The current stigma around mind health is rooted in a cultural silence around this subject. If people fear talking about it, it is because there is a pervasive negative view of mind health that permeates every aspect of life. People fear discrimination and being perceived as ‘weak’ in a society that expects people to be perpetually strong. This applies at every stage of life: throughout childhood, in the workplace and also among the elderly. We observe that our understanding of mind health is generally biased by a fragmented approach: we tend to dissociate mental from physical health forgetting the two are intertwined, affect one another, and necessitate a holistic approach. The overriding challenge is to turn the commonly held understanding of “mental health” as an issue into “mind health” as a value. This means incorporating mental health into core actions so as to overcome stigma and contribute to a more resilient society.

…to address the challenges of tomorrow:

The workshop collaboration and exchanges made it possible for the participants to agree on 3 work areas to prioritize for the future.

1. Raising awareness

Even if taboos around mental health persist today, we expect public awareness to grow and to be boosted by a rising number of popular icons speaking up about how they cope with anxiety. This evolution needs to be supported by multiple actions; providing education to all segments of society should, for example, induce a change of perception and behavior; breaking the stigma around mind health also means partnerships between private and public players (TNCs, NGOs, public administrations) and creating a movement that can build up momentum and put mental health in the spotlight.

These initiatives could contribute to developing a culture of openness and compassion throughout society and the workplace. Once the taboo around mental health is lifted, it can pave the way to concrete mental health solutions.

2. Providing “wise” innovative solutions

Tomorrow’s successful solutions will combine tech with human expertise and communities. While tech is a central component, enthusiasm may balloon to a point that some people’s unfamiliarity with its use and their associated anxieties may be overlooked. This is why human support along with tech, be it therapists for their strong expertise, or communities for their empathy, will continue to be crucial to avoid social isolation.

3. Supporting scientific research

Research in the field of mental health is still nascent and requires support from major stakeholders dedicated to furthering and disseminating knowledge, such as AXA. Unlike chronic diseases such as diabetes, mental disorders are not objectively ascertainable through data today. Their detection often rests on subjective and non-measurable parameters (especially for depression-related disorders). In this field, there is a need for better evidence-based research. Science can further contribute to understanding the many factors that influence mental health. It could build more objective indicators, to institute a holistic approach to health and to take into account a greater range of data-based factors from genetics to nutrition (such as the brain-gut axis).

References

[1] World Economic Forum (2019), Empowering 8 Billion Minds, White Paper

[2] The Lancet (2018), Vol. 392, N°10157

CHAPTER 1 - HEALTH

[3] Clark A. et al. (2008), "Relative income, happiness and utility: an explanation of the Easterlin Paradox and other puzzles", Journal of Economic Literature, Vol. 46, N° 1, pp. 95-144

[4] Our World in Data (2018), Life Satisfaction and Mental Health

[5] United States' Central Intelligence Agency, The World Factbook

[6] United Nations Department of Economic and Social Affairs (2019), World Population Prospects 2019, Probabilistic Projections

[7] The Children's Society, The Good Childhood Report 2018

[8] WHO, Child and adolescent mental health

[9] Harris B. (2018), "Half of mental illness begins by the age of 14", World Economic Forum

[10] Primarck B. et al. (2017), "Social Media Use and Perceived Social Isolation Among Young Adults in the U.S.", American Journal of Preventive Medicine, Vol. 53, N°1, pp. 1-8

[11] Russell B. (2017), "Cyber bullying and social media", Hastac

[12] Organization for Economic Cooperation and Development, Family Database

[13] Twenge M.J., Campbell K. (2012), Generational Differences in Young Adults' Life Goals Concern for Others and Civic Orientation 1966-2009", Journal of Personality and Social Psychology, Vol. 102, N°5, pp. 1045-1062

[14] Ogrodniczuk J. (2013), Borderline Personality Disorder", International Encyclopaedia of Rehabilitation

[15] Zanarini M.C. (2005), The McLean Study of Adult Development: Overview and Implications of the First Six Years of Prospective Follow-up, Journal of Personality Disorders, Vol. 19, N°5, pp. 505-523

[16] Chanen A, Sharp, C, Hoffman P and the Global Alliance for Prevention and Early Intervention for Borderline Personality Disorder (Mar. 122017), "Prevention and early intervention for borderline personality disorder: a novel public health priority", World Psychiatry, Vol. 16, N°2, pp. 215-216

[17] Drancourt et al. (2012), "Duration of untreated bipolar disorder: missed opportunities on the long road to optimal treatment", World Psychiatry, Vol. 102, N°5, pp. 1045-1062

[18] Moeller J. et al. (2018), "Highly engaged but Burned Out: Intra-Individual Profiles in the US Workforce", OSF, pp. 1-41

[19] Kronos (2017), The Employee Burnout Crisis

[20] Institute for Public Policy Research (2017), "Flexibility for who? Millennials and mental health in the modern labor market"

[21] World Health Organization (2019), Mental Health Evidence, Burnout an "occupational phenomenon": International Classification of Diseases

[22] Maslach C., Leiter M.P. (2005), "Reversing Burnout 'How to rekindle your passion for your work'", Stanford Social Innovation Review

[23] Glaser E. (2018), "Bullshit Jobs: A Theory by David Graeber review – the myth of capitalist efficiency", The Guardian

[24] Macias E.F. (2012), "Job Polarization in Europe? Changes in the Employment Structure and Job Quality, 1995-2007", Work and Occupations, Vol. 39, N°2, pp. 157-182

[25] Global Entrepreneurship Monitor (2017), Global Report

[26] Muller R. (2019), "Entrepreneurs are burning out, and it's a bigger problem than you think", Thrive Global

[27] Blanding M. (2015) "National Health Costs Could Decrease if Managers Reduce Work Stress", Harvard Business School, Working Knowledge

[28] World Health Organization (2007), Protecting Workers, Health Series N°6, Raising Awareness of Stress at Work in Developing Countries: A modern hazard in a traditional working environment

[29] World Health Organisation (2017), Dementia Infographic

[30] World Health Organization (2017), Dementia: A public health priority / Alzheimer's Disease International, Dementia Statistics

[31] Alzheimer's Disease International (2015), World Alzheimer Report 2015, The Global Impact of Dementia

[32] China: GB times (2018), India: UNFPA (2017), Brazil: WPA (2017)

[33] World Health Organization (2019), Dementia Fact Sheets

[34] Reynolds D. (2018), "Defeating dementia: a cause for optimism", The Telegraph

[35] Jia Tan et al. (2012), The Lay Public's Understanding and Perception of Dementia in a Developed Asian Nation, Dementia and Geriatric Cognitive Disorders, Vol. 2, N°1, pp. 433-444

[36] Kwok S. (2019), AXA HK, CUHK, and Oxford VR, launch Asia's first VR psychological programme

CHAPTER 2 - DATA AND TECHNOLOGIES

[37] Future Market Insights (2018), Behavioural Health Market: Global Industry Analysis 2013–2017 and Opportunity Assessment 2018–2028

[38] White Star Capital (2018), Mapping out the Mental Health start-up ecosystem

[39] Gaussen E. (2018), Mapping out the Mental Health start-up ecosystem

[40] Jex C. (2017), Birth control app invented by physicists gets EU approval, ScienceNordic

[41] Medical Advise Network (2019), Cognoa devices for autism obtain FDA breakthrough status

[42] Food and Drug Administration (2019), Examples of Device Software Functions the FDA Regulates

[43] World Health Organization (2017), Mental Health Atlas

[44] Jiang F. et al. (2017), "Artificial intelligence in healthcare: past, present and future", Stroke and Vascular Neurology, pp. 1-14

[45] Liu R., Hemaraj Y., Bose A. (2018), "Digital Transformation of Healthcare – state of the Union", Benhamou Global Ventures Forum.

[46] Marr B. (2019), "The incredible ways artificial intelligence is now used in mental health", Forbes

[47] Institute of Mental Health (2015), Media Release

[48] Pescosolido B.A. (2013), "The Public Stigma of Mental Illness: What Do We Think; What Do We Know; What Can We Prove?", Journal of Health and Social Behavior, Vol. 54, N°2, pp. 1-21

[49] Ritter K. et al.(2010), "Mental health beliefs between culture and subjective illness experience", Neuropsychiatric, Vol. 24, N°1, pp. 33-41

[50] AXA PPP Healthcare (2018), Mental Health Issues in Workplace

[51] European Commission (2014), Directorate General Employment, Social Affairs and Inclusion, Working Conditions, Flash Barometer 398

[52] Endered, Ipsos (2016), Understand and improve the well-being at work

[53] Chartered Institute of Personnel and Development (2019), Health and well-being at work

[54] Discovery, How Vitality Works

[55] Gelles, D. (2015), Mindful Work, Eamon Dolan Books

[56] Venkatesan P. (2019), "Digital phenotyping: a revolution or a privacy breach?" , Med City News

[57] Metz R. (2018), "The smartphone app that can tell you're depressed before you know it yourself

[58] AXA PPP Healthcare, Yougov (2017), "Health tech could be the key to a fitter, healthier, workforce"

[59] Marginalia (2018), "Workers willing to wear tech devices to detect mental health conditions", Future of Earth

[60] Frost and Sullivan (2018), "Femtech-Time : for a digital revolution in the women's health market"

[61] Frost and Sullivan (2018), ibid

[62] Institute for Health Metrics Evaluation (2017), Share of population with mental or substance disorders, male vs female

[63] Our World in Data (2017), The effect of child's birth is especially significant on women's life satisfaction

[64] The United Nations, Gender statistics

[65] Royal College of Obstetrics and Gynecology (2017), Maternal Mental Health – Women's Voices

[66] Frost and Sullivan (2018), ibid

[67] Lovett L. (2019), Mental Health apps plentiful but few provide clinical research

[68] Turner P. G., Lefevre C.E. (2017), Instagram use is linked to increased symptoms of orthorexia nervosa, Eating and weight disorders, Vol. 22, N°2, pp. 277-284

CHAPTER 3 - ENVIRONMENT

[69] British National Association for Mental Health (2015), Making sense of Ecotherapy

[70] Song, C. (2016), Physiological Effects of Nature Therapy: A Review of the Research in Japan, International Journal of Environmental Research and Public Health, Vol. 13, N°8

[71] Temming M. (2018), Virtual Reality Therapy has real life benefits

[72] Tull M. (2018), Virtual Reality Exposure Therapy

[73] Wiederhold B.K., & Wiederhold M. D. (2005), Virtual reality therapy for anxiety disorders: Advances in evaluation and treatment, American Psychological Association, 225 p.

[74] Slayton S.C., D'Archer J., Kaplan F. (2011), Outcome studies on the efficacy of art therapy: a review of findings, Art Therapy: Journal of the American Art Therapy Association, Vol. 27, N°3, pp. 108-118

[75] Maratos A. et al. (2008), Music therapy for depression, Cochrane Database of Systematic Reviews, N°1

[76] McCoy T. (2019), 15 Art Therapy Activities

[77] Pew Research Center (2018), Global Attitudes Survey, Q22d

[78] Clayton S. et al. (2017), Mental Health and Our changing climate: impacts, implications and guidance, Washington,D.C, American PsychologicalAssociation, and ecoAmerica.

[79] Strokes B. et al. (2015), Global Concern about Climate Change, Broad Support for Limiting Emissions

[80] Triodos Bank (2019), How is environment making us feel?

[81] Global Change Research Program (2019), Climate and Health Assessment, Mental Health and Well-being

[82] Leiserowitz A. et al. (2019). Climate change in the American mind: April 2019, Yale University and George Mason University

[83] Rubonis A. V., & Bickman L. (1991), "Psychological impairment in the wake of disaster: The disaster–psychopathology relationship", Psychological Bulletin, Vol. 109, N°3, pp. 384-399

[84] Dohery T.J., Clayton S. (2011), "The psychological impacts of global climate change", American Psychologist, Vol. 66, N°4, pp. 265-276

[85] Intergovernmental Panel on Climate Change (2012), Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Cambridge University Press, 582 p.

[86] Launcet Countdown Report (2018), Briefing for Canadian Policymakers

[87] Albrecht G. et al. (2007), "Solastalgia: the distress caused by environmental change", Australasian Psychiatry, Vol. 15, N°1, pp. 95-98

[88] Cunsolo A, Ellis N. (2018), "Ecological grief as a mental health response to climate change-related loss", Nature Climate Change, Vol. 8, pp. 275-281

[89] United Nations (2018), Revision of world urbanization prospects

[90] World Economic Forum (2019), Air pollution may be affecting how happy you are

[91] Guebner O. et al. (2017), "Cities and mental health", Deutsches Ärzteblatt International, Vol. 114, N°8, pp. 121-127

[92] Peen J. et al. (2010), "The current status of urban-rural differences in psychiatric disorders" Acta Psychiatrica Scandinavica, Vol. 121, pp. 84-93

[93] Vassos E. et al. (2012), "Meta-analysis of the association of urbanicity with schizophrenia", Schizophrenia Bulletin, Vol. 38, N°6, pp. 1118–1123

[94] World Economic Forum (2019), Air pollution may be affecting how happy you are

[95] Sass V. et al. (2017), "The effects of air pollution on individual psychological distress", Health & place, Vol. 48, pp.72-79

[96] Kim C. et al. (2010), "Ambient particulate matter as a risk factor for suicide", American journal of Psychiatry, Vol. 167, N°9, pp. 1100-1107

[97] Lim Y. H. et al. (2012), Air pollution and symptoms of depression in elderly adults. Environmental health perspectives, Vol. 120, N°7, pp. 1023-1028

[98] Becerra T. A. et al. (2012), Ambient air pollution and autism in Los Angeles county, California, Environmental health perspectives, Vol. 121, N°3, pp. 380-386

[99] Sunyer J. et al. (2015), Association between traffic-related air pollution in schools and cognitive development in primary school children: a prospective cohort study. PLoS medicine, Vol. 12, N°3

[100] Greenpeace International (2019), Latest air pollution data ranks world's cities worst to best

[101] World Health Organization (2018), New WHO noise guidelines for Europe released

[102] Hjortebjerg, D. et al., (2015), Exposure to road traffic noise and behavioral problems in 7-year-old children: a cohort study, Environmental health perspectives, Vol.124, N°2, pp. 228-234

[103] Chepesiuk R. (2019), Missing the dark: health effects of light pollution, Environmental Health Perspectives, Vol. 117, N°1

[104] World Health Organization (2014), Urban Green Spaces and Health

[105] Fone D., et al. (2014). Effect of neighbourhood deprivation and social cohesion on mental health inequality, Psychological medicine, Vol. 44, N°11, pp. 2449-2460

[106] Lassale C. et al. (2018), Healthy dietary indices and risk of depressive outcomes: a systematic review and meta-analysis of observational studies, Molecular Psychiatry, Vol. 1

[107] Koga M. et al. (2017), Mediators of the effects of rice intake on health in individuals consuming a traditional Japanese diet centered on rice, PloS one, Vol. 12, N°10

[108] Wu, S., et al. (2015), Omega-3 fatty acids intake and risks of dementia and Alzheimer's disease: a meta-analysis, Neuroscience & Biobehavioral Reviews, Vol. 48, pp. 1-9

[109] Rogalsky D. et al. (2019), Nutritional and Metabolic Therapy

[110] Mood Food (2019), Preventing Depression through food

[111] Valles-Colomer M. et al. (2019), The neuroactive potential of the human gut microbiota in quality of life and depression. Nature microbiology, Vol. 4, N°4, 623 p

[112] Srinivasan K. (2005), Role of spices beyond food flavoring: Nutraceuticals with multiple health effects, Food Reviews International, Vol. 21, N°2, pp.167-188

[113] Philippat C. et al. (2017), Prenatal exposure to nonpersistent endocrine disruptors and behavior in boys at 3 and 5 years, Environmental health perspectives, Vol. 125, N°9

[114] Pike A. (2019), What is the MIND Diet?

[115] Luppino F. et al. (2010), Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies, Archives of general psychiatry, Vol. 67, N°3, pp. 220-229

[116] Mood Food (2019), ibid

[117] News Medical, What are Neutraceuticals?

[118] Mordor Intelligence (2018), Nutraceuticals Market, Growth, Trends and Forecast

[119] Wallace C. J., Milev R. (2017), The effects of probiotics on depressive symptoms in humans: a systematic review. Annals of general psychiatry, Vol. 16, N°1

[120] Zaraska M. (2013), Is Lab-grown meet Good for Us?, The Atlantic

[121] Valles-Collober M. et al. (2019), The neuroactive potential of the human gut microbiota in quality of life and depression, Nature Microbiology, Vol. 4, pp. 623-632

CHAPTER 4 - SOCIO ECONOMICS

[122] United Nations (2019), What we have learned over the last ten years: A summary of knowledge acquired and produced by the UN system on drug related matters, pp. 11-18

[123] United Nations (2019), Global Smart Update

[124] Gusovsky D. (2016), Americans consume vast majority of the world's opioids, CNBC

[125] United Nations (2019), Global Smart Update

[126] Global Drug Survey 2019, GDS 2019 Key Findings Report

[127] Zion Market Research (2019), Nootropics Market By Application: Global Industry Perspective, Comprehensive Analysis, and Forecast, 2017-2024

[128] European Agency for Safety and Health at Work (2018), Managing performance-enhancing drugs in the workplace: an OSH perspective

[129] Shao G. (2019), Medical cannabis is gaining momentum, CNBC

[130] The Economist (2019), A global revolution in attitudes towards cannabis is under way

[131] Deloitte, 2018 Cannabis Report

[132] World Health Organization, Management of substance abuse, Cannabis

[133] Avraham Y. et al. (2017), The Impact of Δ9-THC on the Psychological Symptoms, Israel Journal of Psychiatry and Related Sciences, Vol. 54, N°3, pp. 44-51

[134] Häuser W.,Petzke F. (2019), Evidence of the efficacy and safety of cannabis medicines for chronic pain management: A methodological minefield, Bundesgesundheitsblatt Gesungheitforschung Gesundheitsschutz, Vol. 62, N°7, pp. 836-844.

[135] Goldhill O. (2019), The world's first magic mushroom research center is launching in Jamaica, Quartz

[136] John Hopkins University (2019), Effects of psilocybin Anorexia Nervosa

[137] Matthews-Jing A. (2019), Magic mushrooms could replace antidepressants within five years, says new psychedelic research centre, The Independent

[138] In the US, Canada, the United Kingdom, Germany or China

[139] World Health Organization (2018), Depression Fact Sheets

[140] Adams M.A. et al. (2019), In vivo production of psilocybin in E. coli, Metabolic Engineering, Vol. 56, pp. 111-119

[141] Léger D., Bourdillon F. (2019), Le déclin du temps de sommeil en France n'est pas une fatalité, Bulletin Epidémiologique Hebdomadaire, pp. 146-148

[142] Centers for Disease Control and Prevention (2018), Sleep and Sleep Disorders

[143] Léger D., Bourdillon F. (2019),ibid

[144] Wikipedia, Workaholic

[145] Griffith E. (2019), Why are young people pretending to love work?, The New York Times

[146] Herrera T. (2018), "The Simplest Way to Drastically Improve your Sleep: More Sleep", New York Times

[147] Van Dam N., Van der Helm E. (2016), "The Organizational Cost of Insufficient Sleep", McKinsey&Company Quarterly

[148] Baron K.G. et al. (2017), Orthosomnia : Are Some Patients Takign the Quantified Self too Far?; Journal of Clinical Sleep Medicine, Vol. 13, N°2, pp. 351-354

[149] Wallace B., Mendelson M.D. (2019), "Sleep and Depression", American Sleep Association

[150] World Sleep Day

[151] Mirror Wildnerness (2018), "Darpa wants soldiers'minds controlling machines and vice versa"

[152] World Health Organization and Calouste Gulbenkian Foundation (2014), Social determinants of mental health

[153] BBC's Loneliness Experiment (2018), The Anatomy of Loneliness

[154] Ipsos (2019), Global Advisor Predictions

[155] World Inequality Lab (2018), World Inequality Report

[156] Wilkinson R., Pickett K. (2018), The Inner Level, How More Equal Societies Reduce Stress, Restore Sanity and Improve Everyone's Well-being, Penguin Press, 352 p.

[157] World Health Organization (2017), Depression and Other Common Mental Disorders

[158] Acronym for people who are Not in Employment, Education or Training

[159] The Tavistock Institute (2014), Personal Relationships and Poverty

[160] Organization for Economic Cooperation and Development (2011), Doing Better for Families

[161] Walton A.G. (2019), Loneliness Linked To Negative Social Media Experiences, Study Finds, Forbes

[162] World Health Organization (2017), Mental Health Atlas

[163] Ainge Roy E. (2019), "'I feel hopeful': New Zealanders cautiously welcome Well-being Budget" , The Guardian

[164] World Health Organization (2014), Social determinants of mental health, p.21

[165] Science Daily (2019), Study highlights power of play

[166] Layard R. (2006), Happiness and public policy: a challenge to the profession, The Economic Journal, Vol 116, N°510, pp. 24-33

[167] World Happiness Report 2019

[168] Graeber D. (2018), Bullshit jobs: the rise of pointless jobs and what can we do about it, Allen Lane

[169] Illouz E., Cabanas E. (2018), Happycratie : comment l'industrie du bonheur a pris le contrôle de nos vies, Premiers Parallèles

[170] Wood A.M. (2016), "A Dark side of gratitude? Distinguish between beneficial gratitude and its harmful impostors for the positive clinical psychology of gratitude and well-being", The Wiley Book of Positive Clinical Psychology", pp. 137-151

[171] Sengupa et al. (2012), "How much happiness does money buy? Income and subjective well-being in New Zealand", New Zealand Journal of Psychology, Vol. 41, N°2, pp. 21-34

Glossary

To clarify the notions used in this document, the definitions we have adopted are:

• Health
According to WHO, health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

• Well-being, Wellbeing, Wellness
The experience of health, happiness, and prosperity. It includes having good mental health, high life satisfaction, and a sense of meaning or purpose.

• Mental health, Mind health, Behavioral health
A state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to contribute to her or his community. The positive dimension of mental health is stressed in WHO's definition of health as contained in its constitution. "Mental health" is more common in the medical field, but "mind health" is also used and carries a more global perspective.

It is important to keep it mind that mental health is more than the absence of mental disorders:

• It is an integral part of health; there is no health without mental health.

• It is determined by a range of socioeconomic, biological and environmental factors.

Although the terms are often used interchangeably, poor mental health and mental illness are not the same. A person can experience poor mental health and not be diagnosed with a mental illness. Likewise, a person diagnosed with a mental illness can experience periods of physical, mental, and social well-being.

• Mental disorder, Mental illness
A broad range of problems, generally characterized by conditions that affect a person's thinking, feeling, mood or behavior, such as depression, anxiety, bipolar disorders, or schizophrenia. Such conditions may be occasional or chronic and affect someone's ability to relate to others and to function daily. Most of these disorders can be successfully treated.

Acknowledgments & credits

The Foresight Team would like to express its thanks and appreciation to all those who have inspired us and to the people from AXA who directly contributed to this project.

This Foresight Report is the achievement of the AXA Group Foresight Team:

Marie BOGATAJ, Olivier DESBIEY, Arthur BROCHEN, Mathilde BONVIN, Amélie CLERC, Thomas HAVY.

The Foresight Team would like to express its thanks and appreciation to all colleagues from AXA who directly contributed to this project.

Samaa AL AZZAWI, Sohel ABU, Paul BENNETT, Bénédicte BERNEAUX, Somesh CHANDRA, Romain CHAMPETIER, Charles-Etienne de CIDRAC, Carlene CLIFFORD, Patrick COHEN, Richard COOPER, Patrick CORBETT, Sandrine COULANGE, Ulrike DECOENE, Madeleine-Sophie DEROCH,E Frank DESVIGNES, Christophe DURAND-MANICLA,S Noel EYRES, Sophie FURTAK, Caroline GALINIER-WARRAIN, Marcelo GIOVANETTI, Sara GORI, Marta GRECH, Estelle HASCOËT, Parul KAUL-GREEN, Yi Mien KOH, Stéphane LAGO, Victoria LAMOUR, Susana LOPEZ RUIZ, Ning LU, Clotilde LUPPI, Cyrille MAGNETTO, Estelle METZ, Camille NIBERON, Arup PAUL, Alice PELLERIN, Sylvia PERDRIEU, Elisabetta PERETTI, Phillipe PRESLES, Bart TEEUWEN, Maxime QUENIN-CAHN, Dani SAURYMPER, Xing SUN, Linden THOMSON, Gordon WATSON, Cécile WENDLING, Beatrice WING.

And to all the participants of the 2019 Foresight Day in Milan who generously brought up their vision of the future of mental health and well-being.

We are grateful to the ISCOM students for their hard work in the achievement of design fiction scenarii.

BeBiot scenario: Mathilde BRUNAGEL Chloé COUMES Laure GUIGUE Angélique KATCHADOURIAN Raphaël RAGUET Juliette REBOUL Remy ZALCMANN.

AXEL scenario: Laura ANGELIER Alice PHAN Alix COLLERI LEDUC Oriane FROUIN Tracy HONEN Alice PHAN Tara RODRIGUEZ Manon THOVISTE.

Finally, we would like to thank external experts for their contribution to our research and especially the speakers of the 2019 Foresight Day for their insight.

Yohan ATTAL, Lucia CEJA, Timothy GRIBAUDI, Sonia MALASPINA, Serge MICHENAUD, Matthew PATRICK, Esther PERRIN, Morgan POULIZAC, Dekel TALIAZ, Pierre VANDERHAEGHEN.

Photo credits
P.03 Benjamin Boccas
P.62-63 Stefano Cotardo, AXA

Published by AXA
25 Avenue Matignon,
75008 Paris, France

Design & Artwork
Spintank <</>
This guide was printed by Kossuth (Paris, France).
All rights reserved worldwide, AXA 2020 ©