



# CREATING AN INTEGRATED APPROACH TO NONCOMMUNICABLE DISEASES:

Through Focus on Patient-Centered, Sustainable, Scalable Local Solutions



## FOREWORD

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Each year, noncommunicable diseases (NCDs) kill 41 million people worldwide and account for seven of the top 10 leading causes of death globally (1, 2). More than 15 million people between the ages of 30 and 69 years die prematurely from NCDs, and many of these deaths can be prevented (1). Over 80% of all premature NCD deaths are linked to four major disease groups (i.e. cardiovascular disease [CVD], cancer, chronic respiratory diseases, and diabetes) (1).

It is unacceptable that millions of people still live in circumstances that promote disease rather than health, are denied access to lifesaving treatments and care, and are deprived of the ability to live long and healthy lives (3). We know that the financial and social burden of NCDs is immense, but the financial investment to alleviate

this burden on patients, families, and caregivers is comparatively small. Less than 2% of donor assistance for health is spent on NCDs, but investing more will save both lives and money (4). The average annual economic losses from NCDs on a per-capita basis amounts to US\$25 in low-income countries (LICs), US\$50 in low and middle-income countries (LMICs), and US\$139 in upper middle-income countries (4, 5). In contrast, the investment required in population-based and individual-level “best buys” to reduce and prevent NCDs in upper middle-income countries is in the much lower range of US\$0.40–3 (4). The economic case for NCD prevention and control is unchallenged; every US\$1 invested in NCDs will yield a return of US\$7 by 2030 (6).

People living with NCDs require an active and long-term therapeutic alliance with their physicians. Many experts believe that chronic diseases are managed most effectively when patients take an active role in this themselves. Patient-centered healthcare is a concept designed to ensure that patients needs and preferences are at the center of all aspects of healthcare. There are several potential barriers to patient-centered healthcare for NCDs. These include the lack of integration of healthcare into daily life, the healthcare-centered focus that predominates among policy makers and healthcare professionals, the structure of health systems, the lack of effective partnerships and information, and a relative absence of patients in decision-making processes. A shift toward patient-centered healthcare can increase a patient’s engagement and satisfaction with the delivery of their overall care and, ultimately, improve disease outcomes. This shift demonstrates that there are a multitude of opportunities for Viatriis to improve care and outcomes for patients with NCDs (7, 8).

In 2020-2021, the COVID-19 pandemic had a devastating impact on people living with NCDs, including increased COVID-19-related morbidity and mortality, due to a disruption in essential healthcare services. The COVID-19 pandemic exposed the existing link between NCDs, communicable diseases and health emergencies, and the need to stop addressing health issues in silos (9). New vulnerabilities in health systems emerging from the pandemic threaten to undo the substantial gains in wellness and health prosperity that have occurred over the last century. Vulnerable populations such as the elderly, people living in poverty, those in institutions, and minority groups are paying the price for many years of underfunding and underspending by governments on health.

The current COVID-19 and NCD syndemic compels us to reimagine healthcare based not on how it is now but rather on how it should be by creating sustainable, scalable, patient-centric solutions. It begins with empowering people worldwide to live healthier at every stage of life. **At Viatriis, we have an unwavering belief that better access leads to better health. We commit to tackling existing barriers to healthier lives, building on our unique capabilities to advance holistic health solutions, and working with key stakeholders to achieve better health in the communities we serve.**

Through this white paper, we aim to provide an updated status of NCDs in the COVID-19 pandemic setting based on scientific evidence from multiple leading global health agencies. It explores the recent trends in major NCDs and across world regions and makes a strong call-to-action for all stakeholders in Viatriis and our partners to join hands and work toward creating and implementing effective and localized solutions to relieve the burden of NCDs and invest in building resilient health systems worldwide.



## ACKNOWLEDGMENT

This second edition of an NCD-focused white paper has been prepared by Viatrix Inc. This document builds on the first edition, titled *“Leading the Conversation on Noncommunicable Diseases Worldwide: An Evidence-Based Review of Key Research and Strategies to Develop Sustainable Solutions.”* This document is a result of collaboration from multiple divisions within Viatrix Medical Affairs. We are grateful for the lead authorship of Shekhar Potkar, Lobna Salem, Wei Yu, and Ravi Shankar, along with Barrett Jeffers, Shantanu Donde, Karine de Schaetzen, Olive Jin, Shari Melamed, Adolfo Fuentes-Alburo, Arkady Koltun, Kannan Subramaniam, and Niraksha Jithoo. We thank Raffaella Mantegazza, Ferdinand Kopietz, Maria Luisa Orera-Peña, Alex Aguilera, Sanjay Hadigal, Chris Walker, Tarek Hassan, Dimitris Stefanidis, and Joris van Vugt for their valuable contributions in highlighting other chronic diseases along with major NCDs. We also acknowledge the contributions of Tanaya Bharatan, Kaveri Sidhu, Pai-Hui Huang, Amit Lakhani, and many other colleagues who provided their scientific insights.







## PREFACE

### *Responding to the Global NCD Syndemic Challenge*

*by Shekhar Potkar, MD, MBA*

*Head of Medical Affairs - Emerging Markets & NCD Excellence*

Despite significant medical progress over recent decades, we continue to see a rise in disease burden and substantial gaps in patient outcomes, especially in developing countries. Several domains of health challenges contribute to these gaps, including investment, implementation, and inclusion of stakeholders. To help address these important issues, we have helped build a scientific evidence base for mapping the NCD patient journey across different diseases and highlighted gaps at the touchpoints of awareness, screening, diagnosis, treatment, adherence, and control (10). Our work in NCDs, as well as infectious diseases, with various stakeholder groups has helped to identify two core areas of

focus: the “know-do” gap; and approaching solutions from a “syndemic” (or disease convergence) viewpoint.

On average, translating about 14% of research into practice takes 17 years, an astonishingly long process that results in only a small percentage of findings being implemented (11). This shows that there is a significant delay between developing effective solutions, strategies, and products through research and translating/implementing them to meet local needs and produce positive health impacts for specific populations. Thus, there is a gap between today’s scientific advances and their application between what we know and what is being done. Bridging this “know-do” gap is the most important public health challenge of this century.

To address this gap, we need to focus on knowledge translation (the synthesis, exchange, and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people’s health) and implementation research (defined as the scientific study of the processes used to implement policies and interventions, and the study of contextual factors that affect these processes) (12, 13). This could improve the implementation and impact of prevention, early diagnosis, screening, and treatment management programs.

In simple terms, implementation science means implementing proven interventions in real-world settings by modifying them based on local context and incorporating scale-up processes to meet local needs. Implementation science is a multi-faceted, non-linear process that requires continuous communication with multiple stakeholders and regular evaluation to ensure that strategies are producing the intended results.

There are several reasons why we need to pay attention to implementation research:

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- 1 there are disparities between high-income/LMICs
  - 2 we have the knowledge required to solve most health problems; and
  - 3 implementation science can help to increase the number of interventions that get translated into clinical practice to positively impact health outcomes.
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Finally, we see disease convergence via a complex interplay of NCDs and infectious diseases. “Syndemic” refers to the dynamic relationships and synergies between a cluster of two or more epidemics and the various factors that precipitate their interaction within a population (14, 15). Syndemics require recognition that diseases rarely exist in isolation, and the identification of social, political, economic, and ecological factors that are driving poor health. Taking a syndemic perspective can also help determine how co-occurring diseases, medications, social dynamics, and clinical barriers can actually make people sicker (14).

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**“At Viatris, our scientific approach to solving the twin burdens of infectious disease and NCDs is through application of implementation science principles to address translation gaps and drive collaborations toward integrated care to address the interconnectedness of diseases. ”**

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## *Toward a Comprehensive Approach to Chronic Disease Management*

*by Ravi Shankar, MD*

*Head of Medical Affairs - Global Specialty Excellence & Medical Services*

There is a need to recognize a broader set of conditions and diseases under the NCD umbrella, and this requires coordination and integration across disease areas (including NCDs as well as communicable diseases) to achieve Universal Health Coverage, provide wider access to quality health services, and restore progress toward sustainable development goals (16). Although there is a greater focus on the five main NCDs (cardiovascular disease [CVD], cancer, chronic respiratory diseases, diabetes, and mental health disorders), it is important to recognize that they do not occur in silos; there are a multitude of other chronic NCDs that contribute to the overall NCD burden (17-25).

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**“ Several patients also face multimorbidity, with several diseases co-occurring and/or interacting with the five main NCDs to add to disease burden. ”**

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The group of “other” chronic NCDs, excluding neoplasms, chronic obstructive pulmonary disease (COPD), CVD, and diabetes, encompasses a vast number of deleterious conditions and causes (26), but among the important are common conditions that have a high burden of illness, including chronic pain (27), allergy and anaphylaxis (28), autoimmune diseases such as rheumatoid arthritis, inflammatory bowel disease (IBD) and psoriasis (29, 30), dermatological conditions (31), metabolic-associated fatty liver disease (32, 33), and pancreatic enzyme insufficiency and pancreatitis (34). **To effectively alter the current trajectory of NCDs, understanding the clinical and medical importance of these other chronic conditions is a therapeutic necessity. Complementary strategies involving multimorbidity management and literacy is the need of the hour.**







## *Accelerating Progress on Healthy Aging*

*by Lobna Salem, MD, MBA*

*Head of Medical Affairs - Developed Markets, Japan, Australia & New Zealand*

If we are serious about living longer and healthier lives, patients with NCDs must be empowered to manage their conditions effectively and proactively as they grow older. And there is no time to waste, with aging being the key factor driving the increasing prevalence of NCDs in high-income countries (HICs) (35); the number of older persons worldwide is projected to more than double over the next three decades, reaching over 1.5 billion in 2050 (36).

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**“ In Europe, the median age of the population in 2017 was 42 years, compared with 29 years globally (37). In 2019, the proportion of the US population aged  $\geq 65$  years was 16.5%, and this figure is expected to reach 22% by 2050 (38). Corresponding figures for Japan are 28% in 2019, reaching 38% by 2050 (39). ”**

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Healthy aging is a critical concept enabling us to add quality of life to quantity of life, while minimizing the impact of NCDs. Partnerships are central to achieving healthy aging, as shown by the European Innovation Partnership with Viartis on Active and Health Ageing (EIP on AHA) (40). This multistakeholder partnership approach was developed by the European Commission, recognizing that collaboration can help to strengthen research and innovation into healthy aging. **Several of the six action groups of the EIP on AHA highlight key areas of focus relevant to NCDs, specifically adherence to prescription and medical plans and integrated care for chronic diseases (41).**

Adherence to prescribed medication is essential for the benefits of therapy to be achieved and leads to more efficient use of healthcare resources, with the ultimate aim of improving health and quality of life and avoiding unnecessary hospitalizations. Integrated care provides health services that are more closely aligned to patient needs and take a multidisciplinary approach to providing care in settings that meet the specific requirements of each individual. Neither of these important concepts can be considered in isolation because integrated care is an important aspect contributing to strategies designed to improve adherence in the elderly (41).

Thus, the aging population demographic, lack of adherence to medication, and failure to integrate and coordinate care are key issues limiting the ability of HICs to adequately address the growing NCD burden. Addressing these aspects requires NCD-related strategies based on collaboration and partnership between a variety of stakeholders, along with patient empowerment, to help turn the dream of effectively managing, and even potentially eliminating, NCDs into a reality. Achieving this vision would have clear benefits not only for individuals and their caregivers and communities, but also for the sustainability of broader healthcare systems.







## *Tackling NCDs in China and Beyond*

*by Wei Yu, MD*

*Head of Medical & Clinical Affairs - Greater China*

NCD-related deaths account for 89% of the total deaths in China, much higher than the global average of 71% (1, 42). CVD accounts for more than 40% of these deaths (42). Each year, the lives of 9.2 million people are cut short due to NCDs in China (42). The number of patients with a diagnosed NCD has reached 260 million, accounting for 70% of the total disease burden – making NCDs the number one health threat in China (43). Reducing premature deaths due to NCDs by 30% by 2030 has been listed as an important goal for Healthy China 2030 (44).

NCDs are largely preventable but, because of the unique features of the NCD epidemic, combating these diseases requires a balanced, life-course approach that spans across the continuum of care, from

health promotion and prevention to screening, diagnosis, treatment, rehabilitation, and palliative care, and from populations to individual patients (45, 46). It also requires integrated collaboration between various stakeholders, from hospitals to The Chinese Center for Disease Control and Prevention, from healthcare professionals (HCPs) to patients, from the private sector to governments, and even the whole of society. The pharmaceutical industry is an important part of this ecosystem.

Viartis has long contributed to this fight against NCDs. We have collaborated with academic associations, developed the first cardiovascular index in the world to guide the nation and each province, worked with the government to develop the appropriate model/techniques on lipid management, and also facilitated lipid screening, which has been incorporated into the 10-year national NCD management plan.

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**“As a global healthcare company, we continue contributing to the fight for human health; we not only provide high-quality medication, but also develop beyond-the-pill solutions such as innovative digital therapeutics. Effective management of NCDs depends largely on continuous, responsive, accessible, and quality services and successful patient engagement and self-management. ”**

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Digital health solutions can help ensure the continuity of care between different health and social settings as well as across the healthcare system. Digital tools can lead to better and faster healthcare which is more empowering and accessible for people at risk of or living with NCDs, more efficient for providers and more cost-effective for health systems – thereby driving progress toward reduced disparity and improving health outcomes (47).

With our tireless efforts and spirit of innovation, we can truly make a difference if we continue to unite the health system – government, healthcare providers, academic institutions, the private sector, and, of course, patients. At Viartis, we are excited to take on the opportunities that lie ahead for us to fulfill our passion as medical professionals to combat one of the greatest health threats of our time: NCDs, especially in under-served markets, including China. Let’s work together to make healthcare as it should be!





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# 1 BURDEN OF NCDs

## Key Points:

NCDs are long-term chronic conditions that are preventable and treatable and often associated with lifestyle-related risk factors

The five-by-five framework calls for an integrated approach for reducing the burden from the five major NCDs, linked together by the multiplicative effect of the five major risk factors

Despite decades of effort, most countries show insufficient progress toward controlling premature mortality from NCDs



Cardiovascular disease



Cancer



Chronic respiratory disease



Diabetes



Mental health conditions

## 1.1 NCD definition

The term noncommunicable diseases (NCDs) refers to a group of diseases characterized by their chronic nature, preventability, long-term and systematic treatment approach, and a health services response that is integrated with acute diseases (1). NCDs are often described as lifestyle-related diseases due to the contribution that modifiable behavior and environmental conditions impact make to their development (1). NCDs are distinct from infectious or communicable diseases, although some NCDs have an infectious component (e.g., cervical cancer, liver cancer, and COPD) (6, 48).

## 1.2 Causes

The likelihood of developing an NCD is influenced by environmental and/or behavioral disease-related risk factors (49). Some of these risk factors are non-modifiable (e.g., age, sex, etc.), but many can be modified. Nearly two-thirds of all NCDs are linked to one or more shared risk factors, including tobacco use, unhealthy diet, physical inactivity, harmful use of alcohol, and air pollution (50). Social determinants of NCDs related to the “causes of the causes” of health inequality include socioeconomic status, gender, ethnicity, disability, urbanization, healthcare system-related factors, etc. (51).

### Behavioral and Environmental Risk Factors

**Tobacco use:** Cigarette smoking is responsible for 71% of lung cancer deaths, 42% of deaths from chronic respiratory disease, and 10% of CVD mortality (52). Over 8 million global deaths were attributed to tobacco use in 2019 (53). Rates of smoking are decreasing across the world but are unlikely to hit the World Health Organization (WHO) target of a 30% reduction set for 2025 (54). At the current rate, only a 22% reduction will be achieved (54).

**Air pollution:** Air pollution is ranked second among environmental and behavioral risk factors. Ambient air pollution is responsible for an estimated 4.2 million

### Behavioral and environmental risk factors for NCDs



Tobacco



Pollution



Physical inactivity



Unhealthy diet



Excessive alcohol

deaths per year due to chronic heart and lung disease, stroke, and cancers (55).

**Physical inactivity:** For adults, physical inactivity is defined as undertaking fewer than 150 minutes of moderate-intensity physical activity per week, and one in four adults and 80% of adolescents worldwide do not achieve this target (56). A sedentary lifestyle is estimated to increase the risk of death by 20-30% compared with an active lifestyle, and is associated with an increased risk of stroke, CVD, hypertension, diabetes, cancer, anxiety, and depression (56). A direct result of modern conveniences, physical inactivity is twice as common in HICs compared with LICs (56).

**Unhealthy diet:** Obesity is a recognized health risk for many NCDs, including CVD, diabetes, and cancer (57). The prevalence of obesity has increased 50% between 2000 and 2016 (58). Although obesity was once considered a problem of HICs, its incidence and impact are now rapidly increasing in LMICs. Obesity is also one of the most pervasive risk factors among children, with a sharp rise in global prevalence over the past 40 years, from 4% in 1975 to 18% in 2016 (59). This trend is causing complications such as diabetes and heart disease to occur in an age group previously less familiar with such conditions.

**Harmful use of alcohol:** Harmful use of alcohol includes high total consumption and heavy episodic (binge) drinking. It is implicated as a causal factor in a large number of diseases, including liver disease, cancers, CVD, mental health disorders, and suicide (60). There were an estimated three million alcohol-attributable deaths and 131.4 million disability-adjusted life-years (DALYs) globally in 2016, corresponding to 5.3% of all deaths and 5.0% of all DALYs (61).



### Modifiable Metabolic Risk Factors

The following four key conditions constitute the main modifiable metabolic risk factors for NCDs (1):



hypertension (high blood pressure)



overweight/obesity



hyperglycemia (high blood glucose levels)



hyperlipidemia (high levels of fat in the blood)

### Healthcare System-Related Factors

These include the following (62):

- lack of integration/coordination of care;
- fragmentation of clinical care;
- underutilization of primary care;
- low patient empowerment;
- selective focus of clinical research; and
- systems and technology limitations.

### 1.3 GLOBAL TRENDS

Preventable, premature mortality from NCDs in both men and women declined by 1.3% per year between 1990 and 2017, with consistent reductions seen across most countries and territories (63). However, there has been a global slowdown in the reduction of preventable mortality from NCDs since 2017, and some highly populous regions are now reporting both an upward trend and high levels of preventable NCD-related mortality (63). Furthermore, the absolute number of preventable NCD deaths increased by nearly 50%, from 23.1 million in 1990 to 34.5 million in 2017 (63).

In 2015, member states of the United Nations adopted the Sustainable Development Goals (SDGs). A total of 17 interlinked goals and 169 targets were set as a universal call to action to achieve the 2030 agenda for sustainable development (64). Goal 3 is to ensure healthy lives and promote well-being for all at all ages and it holds specific targets for NCDs and communicable diseases (64). The SDG target 3.4 has the stated aim of reducing premature mortality from NCDs in 2030 by 33% compared with 2015 levels through prevention and treatment strategies and the promotion of mental health and wellbeing (64). However, a recent literature review suggests that only two out of the 10 NCD progress indicators are being met by at least 50% of the 176 countries who signed the SDGs (65). Policymakers have recommended cost-effective interventions termed “best buys” as strategies to control NCDs and reduce associated behavioral risk factors for achieving the NCD specific targets of SDG 3 (65). Although progress is being made in implementation of taxes to help reduce use of tobacco and alcohol, progress toward improving unhealthy diets through measures for salt and sugar intake reduction or elimination of trans fats in diet is much slower (65). In addition, implementation of comprehensive health examination surveys is behind schedule, which delays the ability to incorporate local data into guidelines for the management of NCDs (65).

“Overall, the current rate of change in NCD trends is insufficient to allow the 2030 SDG targets to be achieved (66).”

- World Health Organization [2020]



## 2 STAKEHOLDERS

### Key Points:

*A unified multisectoral approach from partners in government, national/international organizations, private sector, academia, and civil society organizations is needed to catalyze action against NCDs*

*The pharmaceutical industry plays a pivotal role as a partner in creating awareness, building healthcare capabilities and improving access to basic NCD medicines and technologies*

*The healthcare partnership continuum ranges from simple philanthropic donations to highly complex arrangements with shared goals, division of responsibilities, governance, and tracking predefined success parameters*

To effectively alter the current trajectory of NCDs, it is essential to overcome the silo-based approach to treating NCDs and progress toward a unified “Whole-of-Government” and “Whole-of-Society” agenda. Involvement of partners from government, national/international organizations, private sector, academia, and civil society organizations (CSOs), and across different sectors (e.g., health, education, agriculture, finance, environment) is strongly advocated to catalyze awareness efforts, establish mutual goals, optimize resources, and avoid redundancies for effective planning and implementation of NCD programs.

In addition to being a pivotal player in the development of newer, more effective medicines, the pharmaceutical industry also has a role in safeguarding wider access to affordable quality medicines and technologies for treating and diagnosing NCDs in resource-limited settings.

Pharmaceutical sector partnerships are essential to achieving WHO’s voluntary global NCD targets related to providing drug therapy and counseling for preventing heart attacks and strokes, and ensuring availability of affordable basic technologies and medicines essential for NCD treatment (67, 68).



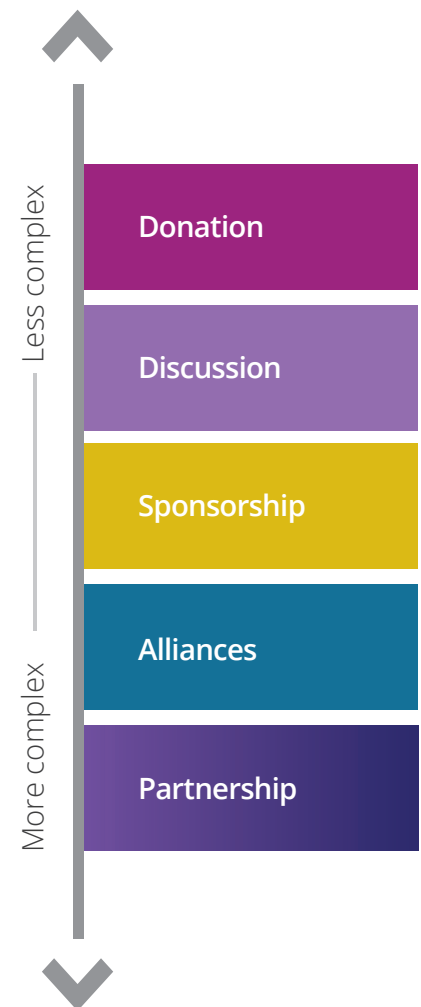


Figure 1. Stakeholders and partnership continuum (adapted from Collins et al, 2019). (67)

### Multisectoral Partners



### Partnership Continuum



CSO, civil society organizations; HCPs, healthcare professionals; NGOs, non-government organizations

Engagement with the private sector spans varying levels of complexity and can be considered as a “partnership continuum” (67). At the lower end of the continuum, interactions are mostly philanthropic or transactional engagements, with infrequent interactions between partners, small resource exchange, narrow scope, and organizational independence. At the partnership end of the continuum, where there are aligned objectives and a shared vision, interactions involve a higher level of engagement, integration, significant two-way

exchanges of resources, broader scope, and shared governance. Partnerships are highly complex arrangements with shared goals, established divisions of resources and expertise, mutual accountability, and joint decision making. To address unmet healthcare needs, several models of partnerships are being defined across the healthcare gamut: clinical integration networks; regional collaborations and arrangements with physician practices; urgent care and retail clinics; pre- and post-acute care providers; community organizations; and payers.

**“ When [engagements] evolve toward transformative partnerships, they can deliver collective action to tackle complex challenges such as NCDs and other related comorbidities (69). ”**

- United Nations [2019]

Table 1. Opportunities for private sector partnerships across the NCD care continuum.

NCD Care Continuum (46)	Partnership opportunities with the private sector
<b>Education &amp; Awareness</b>	<ul style="list-style-type: none"> <li>• Conducting wellness and disease awareness programs</li> </ul>
<b>Prevention &amp; Screening</b>	<ul style="list-style-type: none"> <li>• Promoting disease prevention through reduction of NCD risk factors (healthy workplaces, reformulating unhealthy food products, increasing physical activity, and reducing smoking and excessive alcohol consumption)</li> <li>• Promoting disease prevention through screening and early identification of at-risk populations</li> </ul>
<b>Diagnosis</b>	<ul style="list-style-type: none"> <li>• Establishing clinical practice networks</li> <li>• Facilitating communication channels between healthcare workers and specialists</li> </ul>
<b>Treatment</b>	<ul style="list-style-type: none"> <li>• Developing innovative and more effective therapies</li> <li>• Expanding infrastructure for NCD care in hospitals</li> <li>• Ensuring access to treatment</li> <li>• Delivering integrated care</li> <li>• Adopting the latest treatment guidelines into clinical practices</li> </ul>
<b>Long-Term Disease Management and Rehabilitation</b>	<ul style="list-style-type: none"> <li>• Generating evidence to inform health system-based integrated NCD programs across the care continuum</li> <li>• Expanding access to NCD care (medicines, services, training healthcare professionals and health workers)</li> <li>• Continuation of patient monitoring and management</li> <li>• Ensuring adherence with pharmacological therapy and non-pharmacological interventions</li> </ul>



### 3 LEARNINGS FROM THE NCD & COVID-19 SYNDEMIC

#### Key Points:

*People with NCDs are more vulnerable to severe COVID-19 illness and death as both conditions share common underlying risk factors, i.e., obesity, older age, deprivation, and ethnicity*

*The COVID-19 pandemic created disruptions in essential healthcare services and daily activities worldwide, with a profound effect on population mental health and long-term impact on people living with NCDs*

*This important link between communicable diseases and NCDs moves the solution from a silo-based approach to an integrated approach for treating NCDs and infectious diseases*

In December 2019, a community-acquired pneumonia caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) broke out in Wuhan, China, and quickly spread throughout the world (70). This new coronavirus disease, termed COVID-19 (71) was defined as a pandemic in March 2020 (72). Available data has shown that COVID-19 has “two categories of disease interacting within specific populations – infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and an array of noncommunicable diseases (NCDs) (14).” Thus, the COVID-19 pandemic can be called a syndemic. The Lancet Global Health published a modeling study in 2020, which states that:

**“One in five people are at increased risk of severe COVID-19 should they become infected, mostly as a result of underlying NCDs (73).**

- The Lancet Global Health [2020] //

A systematic review reported that the prevalence of comorbidities in patients with COVID-19 was 21% for hypertension, 11% for diabetes mellitus, 5.8% for CVD, 2.7% for cancer, and 2.0% for chronic respiratory disease (74). Overall, there is a substantial body of published literature showing that people with NCDs, including hypertension, CVD, diabetes mellitus, and chronic respiratory disease, are more vulnerable to severe COVID-19 illness and death (75, 76). This is reflected in the latest Centers for Disease Control and Prevention (CDC) guidance, which includes NCDs such as cancer, diabetes, COPD, CVD, and hypertension in their list of medical conditions that increase the risk of severe COVID-19 illness (77). In addition, a meta-analysis found that “addressing the modifiable risk factors such as smoking, hypertension, and diabetes could reduce morbidity and mortality due to COVID-19” (78).

Furthermore, it is interesting to note that COVID-19 and NCDs share a common set of underlying risk factors, including obesity, older age, deprivation, and ethnicity (79).

As governments issued restrictions of movement, travel restrictions, reprioritization of staff and funding to the acute care of COVID-19 patients, many essential healthcare services were interrupted. In 2020, the WHO reported that disruption to services for hypertension management, treatment of diabetes and its complications, cancer, and CVD emergencies occurred in 53%, 49%, 42%, and 31% of countries, respectively (80). Data from the WHO national pulse survey, released in April 2021, showed that 90% of essential health services were disrupted more than one year into the COVID-19 pandemic (81). Among the services severely affected (disruption reported by >40% of countries) were those for several NCDs, including hypertension, diabetes, and mental health disorders (81, 82). Additionally, broader environmental, political, and social conditions may not be conducive to health promotion activities. Furthermore, lack of access to primary healthcare services can contribute to and exacerbate the development of NCDs (83). Community pharmacists emerged as uniquely positioned frontline healthcare workers with the potential for closing treatment gaps, facilitating adherence, and maintaining contact between patients and the primary healthcare system for NCDs (83-85).

Infection containment measures in many countries to protect the most vulnerable from being exposed to COVID-19 will likely have a potential effect on the long- and short-term management of NCDs (86, 87). The associated decrease in physical activity and exercise has had a negative effect on control of NCD risk factors, thus worsening clinical symptoms (86). The pandemic has also had a profound impact on mental health disorders globally, and the impact of challenges such as enforced isolation, fear of dying and the financial impact of the pandemic will most likely persist long after the pandemic is over (88). In some countries, prevalence rates of anxiety and depression doubled during the pandemic, with the highest rates coinciding with periods of high COVID-19 death rates and strict confinement “lock-down” (89). Therefore, understanding and managing the effects of the pandemic on mental health is just as important as understanding the physical health impacts of COVID-19 (90).

The year 2020 highlighted the important and an inescapable link between communicable and noncommunicable diseases. **During the COVID-19 pandemic, it has become evident that people living with an NCD are at a high risk of infection and suffering severe consequence if infected, including hospitalization and mortality (91). Moreover, the long-term impact of COVID-19 on people living with NCDs may have far reaching consequences on healthy aging (86). There has never been a greater need in favor of a combined approach that benefits all conditions simultaneously (92).**

## 4 NCDs AT A GLANCE

### Key Points:

*The five major NCDs i.e., CVD, cancer, chronic respiratory diseases, diabetes, and mental health disorders are collectively responsible for 70% of all deaths globally*

*These NCDs do not occur in silos; they often co-occur and make the treatment of each condition more challenging and costly for patients, their families, and health systems*

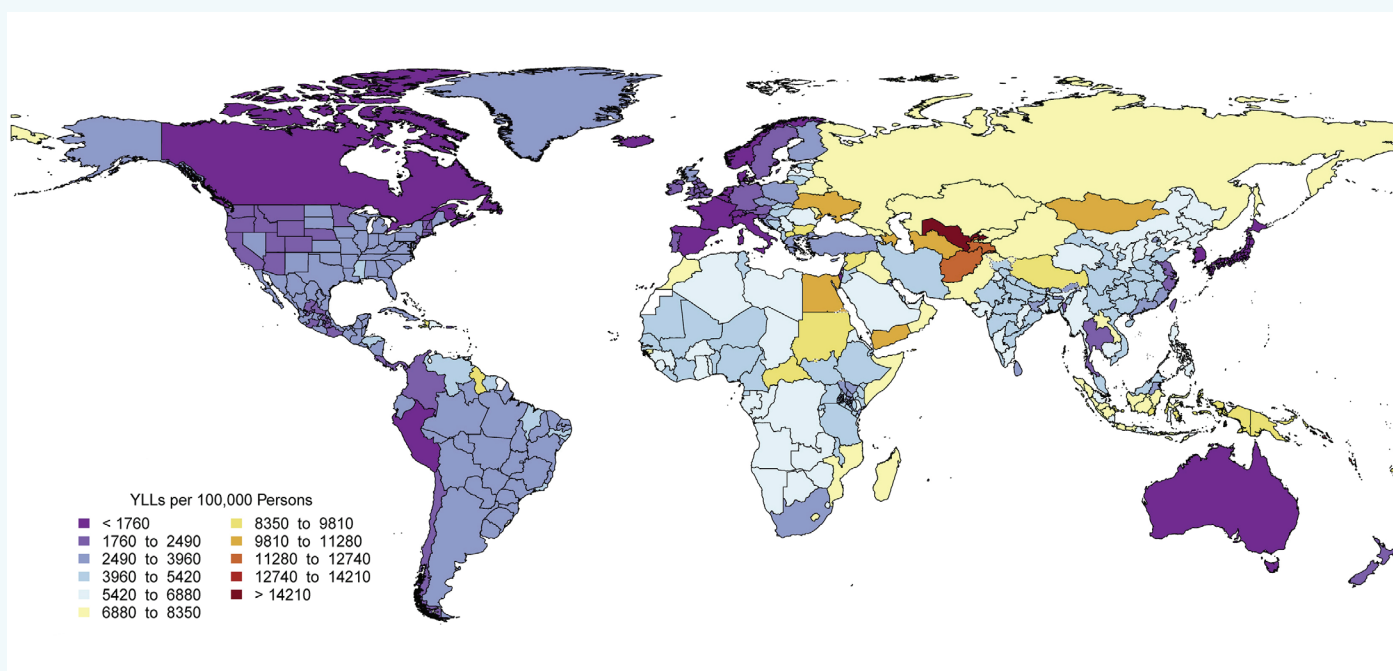
*Comorbidity of communicable diseases and other chronic conditions with NCDs highlights the importance of integrated, collaborative, and multidisciplinary approaches to patient care*



### 4.1 Cardiovascular Disease

**Epidemiology:** CVDs, primarily ischemic heart disease and stroke, are the leading worldwide cause of mortality and a major contributor to disability (93). CVD was the underlying cause of 9.6 million deaths in men and 8.9 million deaths in women in 2019, accounting for about one-third of all deaths globally (93). Both the prevalence and death rate of CVD are steadily increasing; prevalent cases of total CVD nearly doubled from 271 million in 1990 to 523 million in 2019, while the number of CVD deaths steadily increased from 12.1 million in 1990 to 18.6 million in 2019 (93). In terms of disability, the number of years lived with disability due to CVD doubled from 1990 to 2019 (from 17.7 to 34.4 million) (93).

Figure 2. Map of age-standardized years of life lost to CVDs in 2019. (93)



Reprinted with permission from "Roth GA, et al; GBD-NHLBI-JACC Global Burden of Cardiovascular Diseases Writing Group. Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study. *J Am Coll Cardiol.* 2020;76(25):2982-3021." [Copyright©, Elsevier] published under a Creative Commons license: <https://creativecommons.org/licenses/by/4.0/>

**Treatment gaps:** Although age-adjusted CVD mortality rates have decreased markedly over the last 50 years, CVD remains the leading cause of death globally with 19.05 million deaths globally in 2020 and it is expected to increase to 23.6 million deaths per year by 2030 (94, 95). In recent years, CVD mortality is increasingly determined by factors such as geographic location, education, and wealth (96). These disparities may be due to variations in access to basic primary care and treatments to modify CVD risk factors, challenges with social determinants (e.g., level of education and income), and modifiable risk factors (e.g., diet, physical activity, and smoking) (96).

**Implications for practice:** Prevalent cases of total CVD are likely to increase substantially as a result of population growth and aging, especially in Northern Africa and Western Asia, Central and Southern Asia, Latin America and the Caribbean, and Eastern and Southeastern Asia where the proportion of older persons is projected to double between 2019 and 2050 (97). Increased attention to promoting ideal cardiovascular health and healthy aging across the lifespan is necessary. Equally important, the time has come to implement feasible and affordable strategies for the prevention and control of CVD and to monitor results.

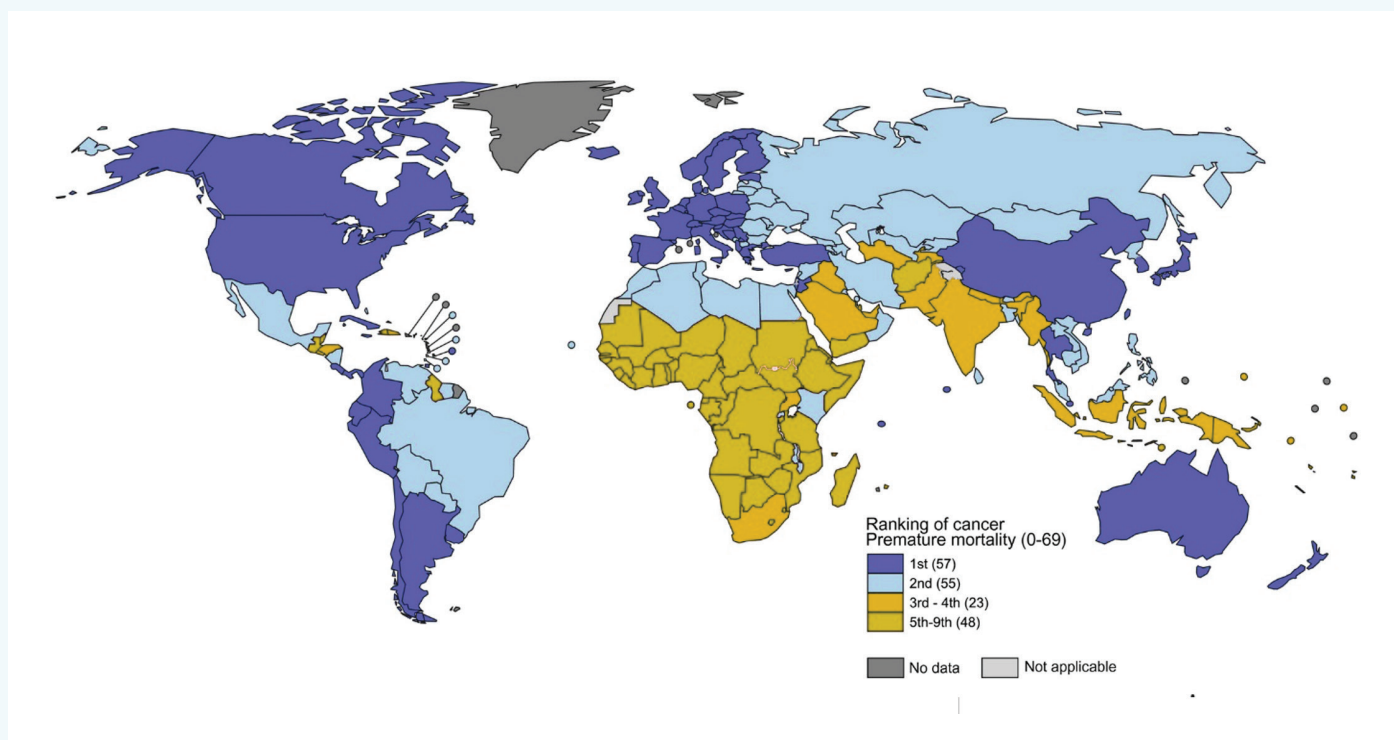


## 4.2 Cancer

**Epidemiology:** Cancer is the second-leading cause of NCD deaths, behind CVD (1). An estimated 19.3 million new cancer cases and almost 10.0 million cancer deaths occurred in 2020 (98). Female breast cancer is the most commonly diagnosed cancer, with an estimated 2.3 million new cases (11.7%) in 2020, followed by lung (11.4%), colorectal (10.0%), prostate (7.3%), and stomach (5.6%) cancers (98). Lung cancer

remains the leading cause of cancer death, with an estimated 1.8 million deaths in 2020 (98). The global cancer burden is expected to reach 28.4 million cases in 2040, up 47% compared with 2020, and with a larger increase in transitioning (64% to 95%) versus transitioned (32% to 56%) countries due to demographic changes, although this may be further exacerbated by increasing risk factors associated with globalization and a growing economy (98).

Figure 3. National ranking of cancer as a cause of death at ages <70 years in 2019. (98)



Reused with permission from "Sung H, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin.* 2021;71(3):209-249." [Copyright© 2021, American Cancer Society]

**Treatment gaps:** Although there has been a decrease in cancer mortality over the period 1990 to 2015, even greater reductions could be achieved if currently available interventions were applied more broadly and equitably (99). Some relevant issues, irrespective of cancer type, include improving health equity and access to high-quality healthcare, better use of data to detect health disparities and improve outcomes, reducing the prevalence of risk factors such as smoking, lack of survivorship care plans for transition to post-treatment life, and management of comorbidities in older patients with cancer that limit the number of potential treatment options (100).

**Implications for practice:** Efforts to build a sustainable infrastructure for the dissemination of cancer prevention measures and provision of cancer care in transitioning countries is critical for global cancer control.





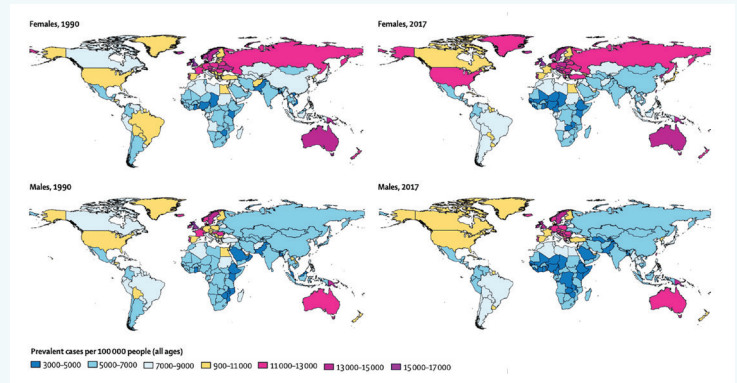
### 4.3 Chronic Respiratory Disease

**Epidemiology.** Chronic respiratory diseases are among the most common NCDs and among the leading causes of morbidity and mortality worldwide (101). Globally, an estimated 545 million people (7.4% of the world population) had a chronic respiratory disease in 2017, an increase of 39.8% since 1990 (Figure 4) (101).

The prevalence of chronic respiratory diseases is highest in HICs and lowest in South Asia and sub-Saharan Africa (101). Smoking is the most common risk factor for death and disability due to chronic respiratory disease in men (101). For women, other environmental factors, including household air pollution from solid fuels and ambient particulate matter are important risk factors in parts of Asia and Africa (101).

Figure 4. Prevalence of chronic respiratory diseases by country in 1990 and 2017. (101)

Reused with permission from “GBD Chronic Respiratory Disease Collaborators. Prevalence and attributable health burden of chronic respiratory diseases, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet Respir Med.* 2020;8(6):585-596.” [Copyright©, Elsevier] published under a Creative Commons license: <https://creativecommons.org/licenses/by/4.0/>



Chronic obstructive pulmonary disease (COPD) is the most prevalent chronic respiratory disease, accounting for more than 55% of all chronic respiratory diseases and causing 3.2 million deaths worldwide in 2017 (101, 102). Although varying by region (103), the prevalence of COPD is predicted to increase worldwide over the coming years (104). Most patients with COPD are not diagnosed until they have moderate-to-severe category disease, attributing their dyspnea (the main symptom of COPD) to advancing age and other comorbidities (105).

**Treatment gaps:** A substantial number of individuals living with a chronic respiratory disease remain undiagnosed, even in developed countries (106). Timely detection of chronic respiratory diseases requires adequate access to and use of diagnostic instruments such as spirometry and chest imaging, as well as effective and practical case-finding approaches (106, 107). Therefore, increasing research funding is essential to developing strategies to detect chronic respiratory diseases at their earliest stage and to accelerate the discovery of novel therapies, which are sorely needed for many of these diseases (106).

COPD exacerbations account for the greatest proportion of total COPD burden on the healthcare system (108). Therapies that can prevent and manage exacerbations, particularly in patients with more severe disease, should decrease the number of hospitalizations and ease some of the economic burden of COPD.

Another relevant unmet need in COPD is better characterization of patient subpopulations (104). The mechanisms driving lung inflammation after smoking cessation are still not well understood. Better definition of pathogenetic subgroups based on molecular mechanisms may help with the identification of biomarkers that would suggest a high likelihood of individual response to a particular treatment or identification of new pathways to target for subpopulations of COPD patients (104).

**Implications for practice:** A key initial step is disease identification and diagnosis, especially for COPD, which requires the availability and appropriate implementation of screening and diagnostic assessments using spirometry and chest imaging (106,107). Another important part of a holistic approach to COPD management is assessment of comorbidities, which are common in patients with COPD (109). These may mimic and/or aggravate exacerbations, and can influence prognosis, hospitalization rates, and mortality. Therefore, COPD comorbidities need to be carefully identified and treated (109). However, polypharmacy is likely when managing COPD and comorbidities, and this needs to be managed appropriately.

Overall, governments, world organizations, medical societies, health systems, healthcare providers, and individuals in the community need to continue to advocate for clean air, tobacco-free environments, and access to care. Similar to the concept of cardiovascular health, it is time to shift the paradigm from prevention of respiratory disease to promotion of respiratory health (106).



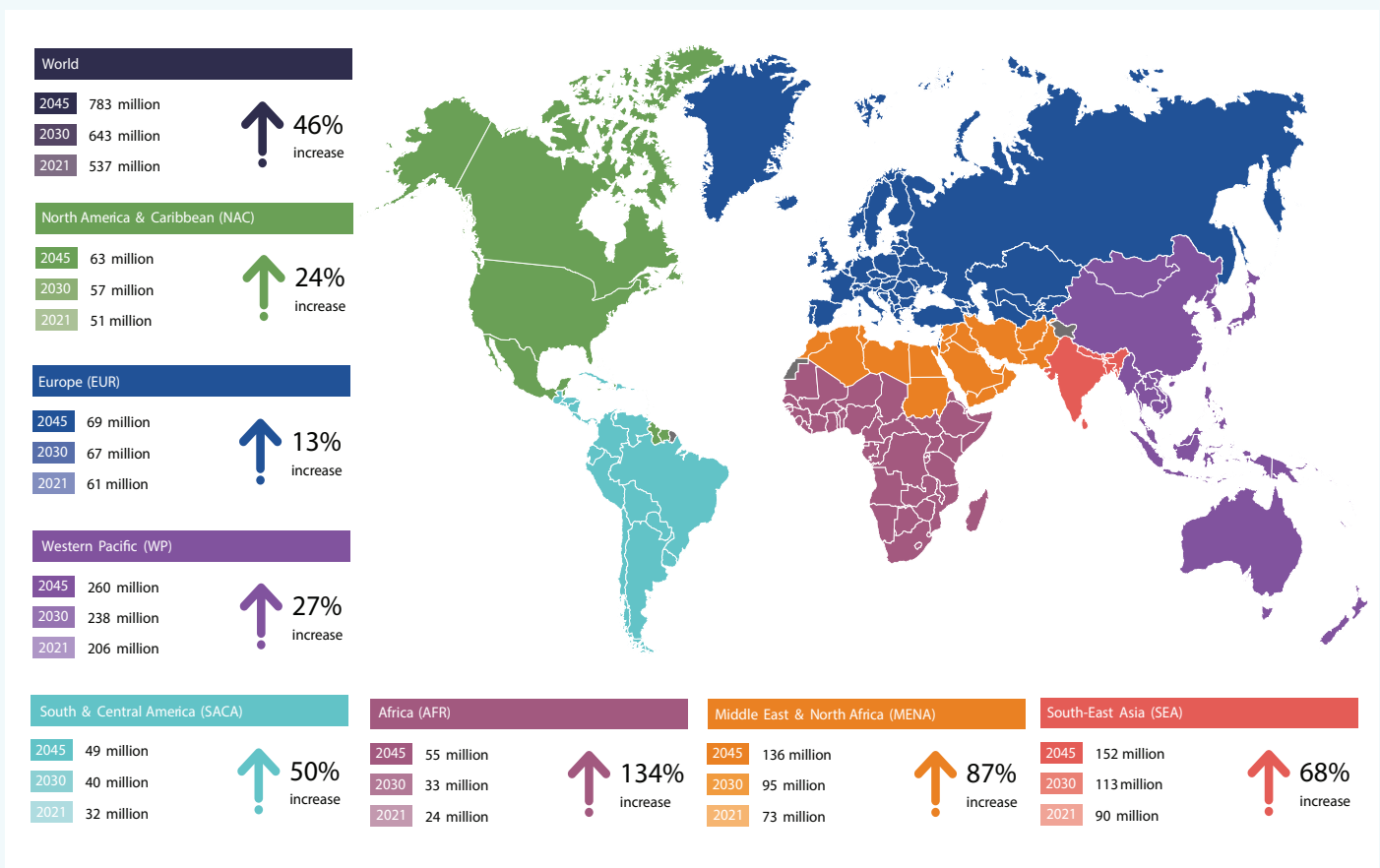
## 4.4 Diabetes

**Epidemiology:** In 2021, an estimated 537 million individuals aged 20-79 years were living with diabetes, a prevalence rate of 10.5% (110). It is predicted that worldwide diabetes prevalence will increase to 11.3% by 2030 (accounting for 642.7 million individuals) and to 12.2% by 2045 (accounting for 783.2 million individuals) (110). Diabetes affects people of all ages, typically showing higher prevalence with increasing age. One in four adults aged 75–79 years are estimated to be living with diabetes in 2021 (110).

An estimated 240 million people are living with

undiagnosed diabetes, i.e., almost one-in-two adults with diabetes are unaware they have the disease (110). Almost 90% of adults with undiagnosed diabetes live in LMICs, and it is estimated that 94% of the increase in the number of people with diabetes by 2045 will occur in these regions (110). Direct health expenditures due to diabetes was close to US\$1 trillion in 2021. North America, Europe, Western Pacific, and Caribbean together account for 87.5% of the global diabetes-related health expenditure (110). The balance (12.5% expenditure) is from South and Central America, South-East Asia, Middle East and North Africa, and Africa regions which are home to 40% of adults with diabetes (110).

Figure 5. Actual and projected diabetes prevalence based on 2021 data. (110)



Reused with permission from “International Diabetes Federation. IDF Diabetes Atlas, 10th edn. Brussels, Belgium: International Diabetes Federation, 2021. <https://www.diabetesatlas.org/> [Copyright©, International Diabetes Federation]

Diabetes is a significant and important risk factor for CVD (110). Nearly one-third of all people with type 2 diabetes are affected by CVD (111). In addition, individuals with type 2 diabetes are at two- to four-fold higher risk of heart failure compared to those without diabetes (112). The risk of other vascular complications is also substantially increased in patients with diabetes, including diabetic retinopathy, diabetic kidney disease, and peripheral vascular disease (110).

**Treatment gaps:** Advances in diabetes care have not always translated into optimal medical care received by patients (113). Even in the US, 30-43% of adults with diabetes fail to meet recommended targets for control of blood glucose, blood pressure, and cholesterol, and less than a quarter (23%) achieve goals for all three of these parameters, with no significant improvement over the period 2005 to 2016 (114). Addressing all important risk factors simultaneously is essential to reduce the risk of atherosclerotic CVD because of the elevated cardiovascular risk present in patients with diabetes.

Challenges to bridging treatment gaps are greatest in LMICs, where there may be a lack of specialist endocrinologists and clinical staff, poor laboratory facilities, and limitations in diabetes treatments and supplies (115). In addition, lack of awareness about diabetes and its complications has a negative impact on patient engagement with healthcare services and adherence to prescribed treatment (115).

There are also economic challenges related to access to medical supplies and pharmacological therapies for many patients in LMICs (116).

**Implications for practice:** Early detection of diabetes is essential to prevent disability and death (110). This requires access to and implementation of appropriate surveillance and detection measures. In addition, reducing the burden of atherosclerotic CVD in patients with diabetes mellitus is a major clinical imperative

that should be prioritized to reduce premature death, improve quality of life, and reduce the personal and economic burdens associated with morbidities, lost productivity, and cost of care (117). To effectively reduce cardiovascular risk in patients with diabetes mellitus requires a holistic, multidisciplinary approach that includes lifestyle interventions, smoking cessation, and control of blood pressure and serum lipids, alongside effective management of plasma glucose levels (118, 119). A focus on patient engagement and empowerment has also been recommended (120).

Current clinical practice guidelines for the management of diabetes may be difficult to implement in LMICs (121). Therefore, there is a need to adapt international guidelines to the socioeconomic context of LMICs, focusing on suitable strategies and a wider target audience to improve the diagnosis, treatment, and control of diabetes (121).



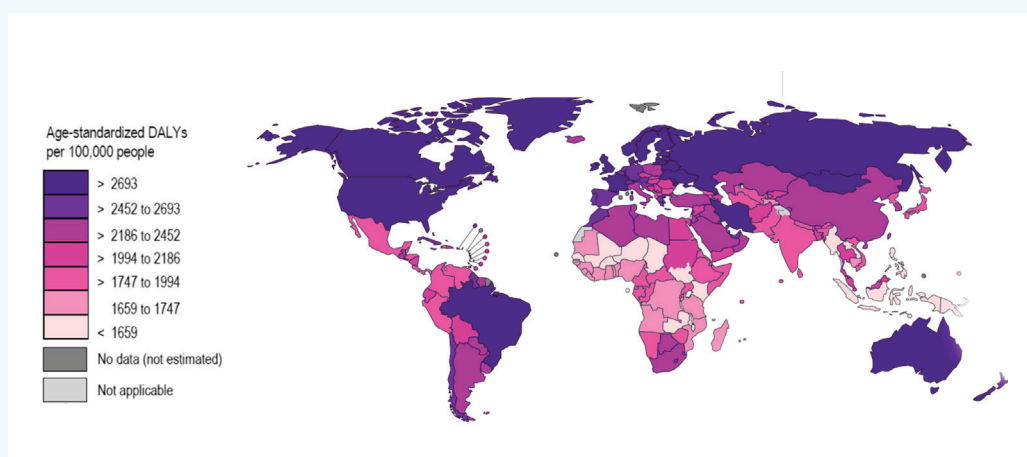
## 4.5 Mental Health

**Epidemiology:** Mental health disorders such as major depressive disorder (MDD), anxiety, schizophrenia, bipolar disorder, and dementia are increasing worldwide (122). In the decade from 2007 to 2017, there was a 13% increase in mental health disorders and substance use disorders (123). In 2016, more than one billion people worldwide were affected by mental or addictive disorders, which is approximately 16% of the world's population (122).

Mental health disorders can have a substantial effect on all areas of life, such as school or work performance, relationships with family and friends, and ability to participate in the community (123). In addition, 20% of all years lived with disability are now due to mental health disorders (123). Globally, 162.5 million DALYs were lost to mental health disorders in 2016, approximately 6.8% of all DALYs lost in that year (122). In addition, mental and addictive disorders were associated with significant disability burden, making up 18.7% of all global years lost to disability (122).

**Figure 6.** Age-standardized DALY rates per 100,000 individuals for mental and addictive disorders in 2016. (122)

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**Treatment gaps:** Compared with other highly prevalent NCDs, such as hypertension and diabetes, treatment rates for mental health disorders are relatively low, indicating a large treatment gap as measured by the difference between the need for treatment and actual treatment delivery among patients with mental health disorders (124). In LMICs, more than three-quarters of all patients who require mental health care do not actually receive any kind of intervention (125).

The WHO has reported that this treatment gap for serious mental health disorders is 35-50% in HICs and 76-90% in LMICs (126).

Stigma is another issue that prevents individuals who are in need of care from seeking services and means that those who begin receiving care often do not complete the treatment plan (127). This has long been recognized by the WHO as a barrier to appropriate care in patients with mental health disorders (123).



Although two of the most common mental health disorders (depression and anxiety) cost the global economy US\$1 trillion every year, the global median government health expenditure that goes toward mental health is less than 2% (123). Another important issue is the comorbidity of depressive illness with other NCDs. A recent review of depression and heart disease reported that depressive illness is more prevalent in those who have had a major cardiac event, with up to 40% of patients meeting the criteria for MDD (128). The European Action on Secondary Prevention through Intervention to Reduce Events (EUROASPIRE) III study involving 22 countries showed potentially even higher rates, with up to 35% of men and up to 65% of women determined to have depression based on the Hospital Anxiety and Depression scale (129). In addition, depression was diagnosed in 47% of recent myocardial infarction patients in the Enhancing Recovery in Coronary Heart Disease (ENRICH) trial (130). Depression and anxiety are also common comorbidities in patients with heart failure (131, 132). Meta-analyses have reported that depression is more likely to occur in patients with diabetes versus without diabetes (odds ratio 1.24–2.90) (132, 133). Co-existence of depression and diabetes also doubles the risk of cardiovascular events (especially stroke) (134), and can contribute to sudden cardiac death (135).

**Implications for practice:** Mental health initiatives need to be integrated into all aspects of health service delivery to better support both mental and physical health in a holistic manner. Barriers that prevent wider adoption of integrated approaches to mental health include separate budgets and payment systems for physical and mental health, the challenge of measuring outcomes and demonstrating value, and cultural or other barriers between organizations or groups of professionals (136). Therefore, work is needed to overcome these barriers in clinical practice. In addition, HCPs need to pay careful attention to avoid stigmatizing patients with mental health disorders because this places an additional barrier to their access to the health services they need (137).

It is important to recognize depression in patients with coronary heart disease (CHD), yet the majority of cases are not diagnosed or managed accordingly (138). The National Heart Foundation of Australia published a consensus statement recommending that routine screening for depression be performed for all patients with CHD, both at initial presentation and during follow-up (139). Evidence suggests that treatment of depression could improve glycemic control (140-142). In a study conducted in primary care, integrated care of diabetes and depression in adults improved adherence to oral antidiabetic therapy and antidepressants, with improved glycemic control and reduced depressive symptoms compared with usual care (143).

## 4.6 Other Chronic Diseases

More than just the five key NCDs listed above contribute to the overall NCD burden worldwide. Many other chronic conditions such as hepatic, renal, and gastroenterological diseases, endocrine, hematological, and neurological disorders, and dermatological conditions are of public health importance as they are closely associated with the major NCDs (68). Chronic low-grade inflammation is a feature common to nearly all NCDs, implicating a central role for the immune system (144). Risk factors of early immune dysfunction include modern dietary patterns, environmental pollutants, and stress; these factors promote inflammation and are common feature in allergic conditions and autoimmune disorders (144, 145). In addition to having an impact on their own, these other chronic conditions often coexist and/or interact with the top five NCDs to add to disease burden. NCD multimorbidity is associated with higher levels of healthcare utilization and greater financial burden (146). The epidemiology and need gaps for selected chronic diseases that are also focus areas for Viatrix are summarized below.

### *Chronic Pain*

**Epidemiology:** In the 2019 Global Burden of Disease survey, low back pain was the fifth highest cause of NCD-related disability, while headache disorders came in eighth (27). In addition, chronic pain is highly prevalent in LMICs (147). Chronic pain has a negative impact on relationships and work life, significantly reduces quality of life, and increases rates of depression (148). Furthermore, patients who experience chronic pain, particularly pain that is severe or disabling in nature, are at significant increased risk of premature death (149-151).

**Treatment gaps:** There is often no cure for conditions where chronic pain is a key symptom and, for most conditions where chronic pain is experienced, symptom relief and maintenance of functionality are the main goals of treatment. Unfortunately, response to treatment is incomplete in just over half of patients (152). Although non-pharmacological options have a role in pain management, low adherence to the prescribed intervention(s) often limits their effectiveness (153). Although opioids provide effective analgesia for many patients, the opioid crisis has highlighted the dangers associated with overuse of these medications and called into question the value of opioid-based strategies for chronic pain management (154), and highlights an unmet need for safe and effective treatment options in this setting.

**Implications for practice:** Chronic pain overlaps with a wide variety of other NCDs to increase morbidity and mortality. This highlights the need for a multidisciplinary, integrated approach to patient care to improve the lives of patients with chronic pain.

### *Allergy and Anaphylaxis*

**Epidemiology:** Allergic diseases are one of the most common early-onset NCDs and associated with immune dysfunction (144). Asthma, allergic rhinitis, atopic dermatitis, and food allergy affect approximately 20% of the world population, can have a serious impact on quality of life, and are associated with significant direct and indirect costs (28). For example, allergic rhinitis is estimated to cost €4,260 per patient per year in Europe (155), and \$3.4 billion annually in the US (156). Anaphylaxis is a dramatic expression of systemic allergy. The lifetime prevalence of anaphylaxis is currently estimated at 0.05-2% in the US and ~3% in Europe (157).

**Treatment gaps:** Management of allergic diseases are based on two pillars: symptomatic treatment of the allergic symptoms; and immunomodulating approach through desensitization, providing a cure by reducing or even stopping the immune response. As chronic diseases, for each approach, disease control depends on adherence to treatment, i.e., taking medications regularly even when no symptoms occur, or in the case of desensitization no immediate improvements are achieved. The first-line treatment for anaphylaxis is intramuscular use of adrenaline; nonetheless, there is hesitancy in using adrenaline as injection and gaps in knowledge when to administer adrenaline, which is critical in the successful suppression of anaphylaxis.

**Implications for practice:** Even though allergic diseases have a global impact there is still underestimation of the disease burden and, consequently, lack of knowledge and communication for all stakeholders. Measures to ensure communication between patients and HCPs, and even pharmacists, are key to understanding the disease burden and are crucial to improving the disease outcome, quality of life (QoL), and the associated costs. Recognition of the symptoms of anaphylaxis by patients and/or caregivers is critical to allow immediate and appropriate actions to be taken (158, 159). Looking past the immediate event, management of triggers and better understanding of what causes individuals to develop anaphylaxis is needed.

### *Autoimmune Diseases*

**Epidemiology:** The overall prevalence of autoimmunity in the general population is about 3-5% (30). There are a large number and wide variety of conditions that are classified as autoimmune diseases, including rheumatoid arthritis (RA), inflammatory bowel disease (IBD), multiple sclerosis, psoriasis, systemic lupus erythematosus, primary biliary cirrhosis, and primary sclerosing cholangitis. Of these, RA, IBD

and psoriasis alone are estimated to affect about 10 million individuals in the US (29). Both genetic and environmental factors play a role in autoimmune disease (30).

**Treatment gaps:** Current approaches to the management of autoimmune diseases focus largely on suppressing or altering the immune response to a level that balances reduction in disease severity with the occurrence of adverse events (e.g., infections) (160). While there have been advances in targeted immunotherapies over recent years, there remains a lack of disease-modifying treatment options for many autoimmune conditions (160). The optimal therapy for autoimmunity would be one that achieves four main goals (161): 1) specifically targets pathogenic cells and leaves the remainder of the immune system functioning normally; 2) re-establishes stable immune tolerance so that continuous or long-term therapy is not needed; 3) has low toxicity and few side effects; and 4) is cost effective compared with alternative approaches.

**Implications for practice:** Looking past the immediate event, management of triggers and better understanding of what causes individuals to develop autoimmune diseases is needed. For chronic autoimmune diseases, a personalized approach to treatment is required, with the target of achieving periods of remission.

### *Dermatological Conditions*

**Epidemiology:** The global prevalence of all skin disease in 2017 was 26.8%, while skin and subcutaneous diseases contributed to 1.8% of all DALYs worldwide in that year (31). Skin disease-related disability is highest, and increasing at the greatest rate, in HICs (31).

**Treatment gaps:** Most skin diseases have a detrimental effect on the lives of patients and their families throughout the lifespan, including decreased QoL and social, academic, and occupational impacts. Atopic dermatitis often persists into or begins in adulthood and places a tremendous financial burden on patients, their families, and society as a whole through direct medical costs and decreased productivity (162). The unmet needs in the diagnosis and treatment of actinic keratosis are successful treatments that relieve both clinical and subclinical lesions, reducing the risk of squamous cell carcinoma and improving the quality of the patient's skin and, consequently, their QoL (163). Anogenital warts are associated with frequent recurrence and repeat physician visits for treatment. However, a safe and effective treatment that can be self-applied by the patient will improve QoL in the condition (164).

**Implications for practice:** Management of dermatological conditions requires more focus on skin disease prevention and providing innovative solutions to healthcare needs in dermatology for a range of skin conditions such as acne, atopic dermatitis, actinic keratosis, wounds, and anogenital warts.



## *Pancreatic Exocrine Insufficiency (PEI)*

**Epidemiology:** This is a condition in which the quantity of pancreatic enzymes secreted after a meal is insufficient for maintaining normal digestion, which causes fat maldigestion and malabsorption, resulting in steatorrhea (165). One of the main causes of PEI is chronic pancreatitis. Chronic pancreatitis is characterized by irreversible and progressive pancreatic inflammation, fibrosis, and scarring, and results in damage and loss of acinar, islet, and ductal cells (34). The annual prevalence rate of chronic pancreatitis is 50 per 100,000 population, the disease develops most often between the ages of 30 and 40 years, and is more common in men than in women (166). Between 25% and 80% of patients with chronic pancreatitis will develop diabetes mellitus (167), and the risk of developing pancreatic cancer is also increased (168).

**Treatment gaps:** The mainstay of PEI treatment is pancreatic enzyme replacement therapy, but the number of new treatments in the pipeline is limited (165, 169).

**Implications for practice:** There is a widespread lack of awareness of PEI among patients, making it difficult to recognize and report the symptoms. Moreover, given that PEI is linked to a variety of different conditions that might be managed by different specialists, there is likely to be inconsistencies in detection, diagnosis, and treatment. Therefore, better education could help with recognition of this important chronic condition.

## *Metabolic-Associated Fatty Liver Disease (MAFLD)*

**Epidemiology:** This is the new term for what was previously referred to as non-alcoholic fatty liver disease. This is the most common type of chronic liver disease, with a global prevalence of 25.24% (170). Metabolic comorbidities associated with MAFLD include obesity (present in over half of patients), type 2 diabetes, hyperlipidemia, hypertension, and metabolic syndrome (170). The high prevalence of MAFLD has been driven by the rapid rise in levels of sedentary

behavior, low levels of physical activity, and excess calorie intake relative to expenditure in nutritionally imbalanced and unhealthy diets (32). These risk factors are common to many other common NCDs, such as CVD and diabetes. Over many years, MAFLD can progress to end-stage liver disease or hepatocellular carcinoma, often leading to liver transplantation or death (171).

**Treatment gaps:** Although the prevalence is high, there is very little awareness of MAFLD. Both physicians and patients underestimate the seriousness of fatty liver disease. Due to a substantial lack of knowledge about its diagnosis and management, the disease is often managed outside guideline recommendations (172).

**Implications for practice:** Current treatment approaches for MAFLD consist of lifestyle modifications, control of cardiometabolic risk factors, correction of modifiable MAFLD risk factors, and prevention of hepatic and extra-hepatic complications (173). However, there are not yet any approved pharmacological treatment options for MAFLD (32, 173).

The presence of other chronic conditions influences the development, progression and response to treatment of major NCDs. The complexities associated with NCD and chronic disease multimorbidities highlight the imperative for integrated, collaborative and multidisciplinary approaches to patient care to ensure effective and holistic patient and disease management.

In addition, both communicable and noncommunicable diseases can occur simultaneously in the same patient. Lessons learned from addressing communicable diseases (e.g., HIV/AIDS and malaria) could also be applied in the setting of NCDs to ensure equitable access and effective care for all patients (174, 175).



## 5 REGIONAL PERSPECTIVES

### Key Points:

*HICs with a high proportion of older individuals are keeping the focus on healthy aging through adherence to therapy and integration of care in the context of management of comorbidities, with a strong focus on patient empowerment*

*China has high prevalence of lifestyle-related and environmental NCD risk factors as well as high NCD mortality rates, which requires greater focus on prevention and risk factor reduction activities*

*LMICs have the highest number of premature NCD-related deaths, which demands a multilateral approach to address the problem at various levels of risk factors reduction, health capacity building, and leveling social determinants of inequity*

### 5.1 Developed Markets - Regional Trends and Strategies

Worldwide population demographics show marked increases in the proportion of individuals aged over 65 years in developed as well as developing countries, although to a lesser extent (176). Given that age is an important risk factor for the development of NCDs (1), this means that the impact of NCDs will continue to be felt in developed markets for many decades to come. In addition, the risk of having more than one comorbid condition increases as a person ages, with most individuals aged over 60 years having multimorbidity (177). Nevertheless, the modifiable nature of many risk factors for NCDs means that the concept of healthy aging is becoming an important consideration in many HICs (178). The expectation is that these diseases can be managed effectively through old age to prevent the increased burden of disease to the patient and on the healthcare system (179).

Poor patient adherence to treatment (or preventive behavior) is increasing the mortality and morbidity burden of NCDs in HICs, with 200,000 attributable premature deaths each year in Europe alone (180). The overall medication adherence rate in patients with chronic diseases is relatively low, at just under 60% (181). In addition, independent predictors of worse adherence in these patients include the presence of at least moderate depression (181), suggesting that achieving adherence in individuals with mental health disorders might be particularly problematic. Using MDD in Spain as an example, reported adherence to medication is about 28% (182, 183). Data from a recent survey conducted in Japan

suggest that factors affecting medication nonadherence in patients with NCDs are related to health awareness, lifestyle, and medication barriers (184).

### VIATRIS INITIATIVES AND PARTNERSHIPS IN DEVELOPED MARKETS

#### Project chAnGE (Europe)

Project chAnGE is a joint program between Viatris and the European Innovation Partnership on Active and Healthy Ageing (EIP on AHA) initiative of the European Commission (185, 186). It aims to identify clinical practice and systems-related gaps in Europe in relation to the prevention and management of NCDs, healthy aging, and support the necessary changes in clinical practice. Project chAnGE focuses on three pillars; adherence, integrated care, and preventing functional decline and has the goal of transforming clinical practice and empowering individuals to manage their health (186).

Five key projects have been supported (187), all of which have patient quality of life at their core:

- Integrated care in frail older adults with non-malignant chronic pain (Italy and Portugal);
- A multidisciplinary approach to improve adherence to medical recommendations in older adults at hospital (Italy);
- Healthy aging through improving cardiovascular risk (England and Ireland);
- Adherence and quality of life measurement in NCDs (Greece); and
- Reduction of hospital visits after discharge through a transitional pharmaceutical care plan for older geriatric inpatients (Belgium).



Project  
CHANGE



### *Active Health Aging and Disease-Specific Strategy for Mental Health Disorders (Japan)*

Japan is reported to have the highest proportion of elderly citizens in the world and is experiencing a “super-aging” society both in rural and urban areas (188). People aged 65 years and over make up one-quarter of Japan’s total population, and it is estimated that this proportion will increase to one-third by 2040 (188, 189). Japan also has high self-harm rates among individuals aged 30-60 years. Therefore, the strategy to reduce NCD burden in Japan consists of a two-pronged approach to 1) achieve healthy aging, and 2) focus on tackling mental health disorders to reduce the burden of suicide.

### *Carenity Project (US and Europe)*

With assistance from Viatris, the international online patient community, Carenity, conducted a study in adults with NCDs in Europe and the US (190). The aim was to assess the real-time impact of COVID-19 on the lives of patients with NCDs (e.g., treatment compliance, access to medication, communication and consultation with HCPs, impact on work and mental health), and determine their expectations regarding information on COVID-19 (190).

The results showed that health conditions worsened in 50% of patients during the lockdown, most often due to the reduction or absence of physical activities, and 17% of patients developed a new disease during the lockdown. More than half of respondents said

that stress levels and state of mind were affected by the lockdown. Patient care was also negatively impacted. More than one-third of patients saw their doctor less than usual, 30% had difficulty in finding an available doctor, 31% did not receive any information related to their chronic illness, and 25% received insufficient information. During the first lockdown, 26% of respondents reported that they changed the way they took some of their long-term treatments (190).

These data highlight the need for better ongoing NCD care and better strategies to manage NCDs during any future infectious disease outbreaks.

## **5.2 Greater China – Regional Trends and Strategies**

In China, 89% of all mortality is attributable to NCDs (42). CVDs were the most common cause of NCD-related death (43%), followed by cancers (23%), chronic respiratory diseases (9%), and other NCDs (13%) (42). China’s rapidly aging population is expected to increase the burden of NCDs by at least 40% by 2030 (191). Rapid urbanization and changing lifestyles will also contribute to a continuous rise in the burden of serious NCDs (192). In particular, high levels of unhealthy behaviors are fueling the local NCD epidemic: approximately 52% of adult men smoke, compared with only 3% of women (193). Exposure to second-hand smoke is also high, occurring in 45.3% of non-smokers in the workplace and 46.7% at home (194).





More than one million people in China die each year from smoking-related diseases (more than 3,000 per day) (195). High salt consumption is another important behavioral risk factor in China, with an average intake of nearly 11 g/day/person (one of the highest rates in the world) (196). Looking at risk factor trends, smoking rates in males, rates of obesity, and the prevalence of elevated blood pressure (BP) are not on track to meet global targets by 2025. In fact, NCDs are one of the key challenges faced by China in achieving 2030 health-related SDGs (197). A World Bank report estimates that the number of NCD cases in Chinese adults aged >40 years will triple by 2030, while NCD-related morbidity and mortality are expected to rise by about 50% and 80%, respectively (191). The economic impact of NCDs for China is estimated at US\$27.84 trillion for the period 2012-30 (197).

A lack of sound care networks has been identified as one of the key challenges for NCD prevention and treatment in China (198). China's health service delivery relies heavily on secondary, rather than primary, care (198). In addition, community health facilities in both urban and rural area have limited capacity to provide preventive care to high-risk populations (198).

As home to the world's largest population, the impact of NCDs in China is likely to have global ramifications. Factors such as substantial geographic and

socioeconomic variability are challenges to development of the integrated care delivery systems that are essential for the implementation, monitoring, and success of strategies to prevent and manage NCDs (198).

### VIATRIS INITIATIVES AND PARTNERSHIPS IN CHINA ASCVD Risk Calculator in Community Hospital System:

The atherosclerotic CVD (ASCVD) risk assessment and comprehensive management project has been designed to focus the attention of HCPs on ASCVD risk assessment and increase the treatment rate of abnormal blood lipid levels (dyslipidemia). Therefore, Viatris has collaborated with clinical experts, an epidemiologist and a laboratory technologist to develop an intelligent ASCVD Risk Estimator. This can automatically capture patient information from the hospital system, assess individual ASCVD risk, provide personalized target values, and generate a personalized health prescription report. This tool was used for over 100,000 patients in general hospitals and community healthcare centers in 2020 and is being installed and used in nearly 100 hospitals in 2021.\*



\*Data on file



**Other projects:** In the Accompany Project, an intelligent cognitive assessment tool is being used to help clinicians conduct early screening, assessment, and standardized management of post-stroke cognitive impairment. In addition, the reliability and validity of the latest local version of the Montreal Cognitive Assessment scale will be verified.\*

Viatrix has partnered with the Cerebrovascular Disease Clinical Medicine Collaborative Innovation Alliance (CDCIA) on the launch of the Liaoning Stroke Health Manager Training Project, which aims to enhance the health management and follow-up intervention of hospitalized stroke patients and reduce their rates of recurrence and mortality. Thirty pilot hospitals in Liaoning Province, China, are participating in the 12-month training plan.\*

The 2020 NCD Talk Show Program was designed in partnership with the Beijing Research Association for Chronic Diseases Control and Health Education to improve general understanding of NCDs and shift the focus from treatment to prevention. More than 200,000 people have participated in the online broadcasts so far.\*

### 5.3 Emerging Markets – Regional Trends and Strategies

The worldwide epidemic of NCDs is developing more rapidly in LMICs than in HICs. Four out of five people with an NCD live in a LMIC (199). In addition, the majority of premature NCD deaths occur in LMICs (199). In fact, nearly half of all NCD deaths in LMICs occur in individuals aged <60 years (200). In addition to the known behavioral risk factors, important contributors to the rise in NCDs in LMICs include growing urbanization, poverty and wealth inequality, and indoor air pollution (201). Addressing NCDs is critical for economic growth and to alleviate poverty,

but NCDs have been acknowledged as a significant threat to achieving internationally agreed-upon development goals (202).

Two regions where the burden of NCDs is increasing at a particularly alarming rate are South Asia and Africa. South Asia is home to nearly a quarter of the world's population (203). As premature death and disability rates due to communicable and nutritional diseases fall, individuals are living longer and are increasingly exposed to behavioral and environmental risk factors, both of which are contributing to rapidly rising rates of NCDs (204). In Africa, it is estimated that NCDs will be the leading cause of death by 2030 (68). In addition, while the global burden of NCDs is projected to increase by 17% over the next decade, the corresponding increase in Africa is estimated to be 27% (205).

There are a variety of significant challenges to the provision of effective and efficient healthcare for NCD treatment and prevention in LMICs (206, 207). Healthcare systems in these regions are often fragmented with multiple stakeholders and are still challenged by the complexity and the long-term nature of NCD management. Inadequately equipped primary care systems do not usually include chronic disease prevention programs such as routine screenings that are essential for the effective prevention and management of NCDs (207). This means that patients are often diagnosed late in the disease course, limiting the number of available options and the effectiveness of treatment. Lack of adequate consultation time with overburdened HCPs, the stigma associated with certain conditions, and poor socioeconomic conditions also contribute to poor health behavior and suboptimal adherence with therapy in LMICs (208).



\*Data on file

## Viatrix Initiatives and Partnerships in Emerging Markets

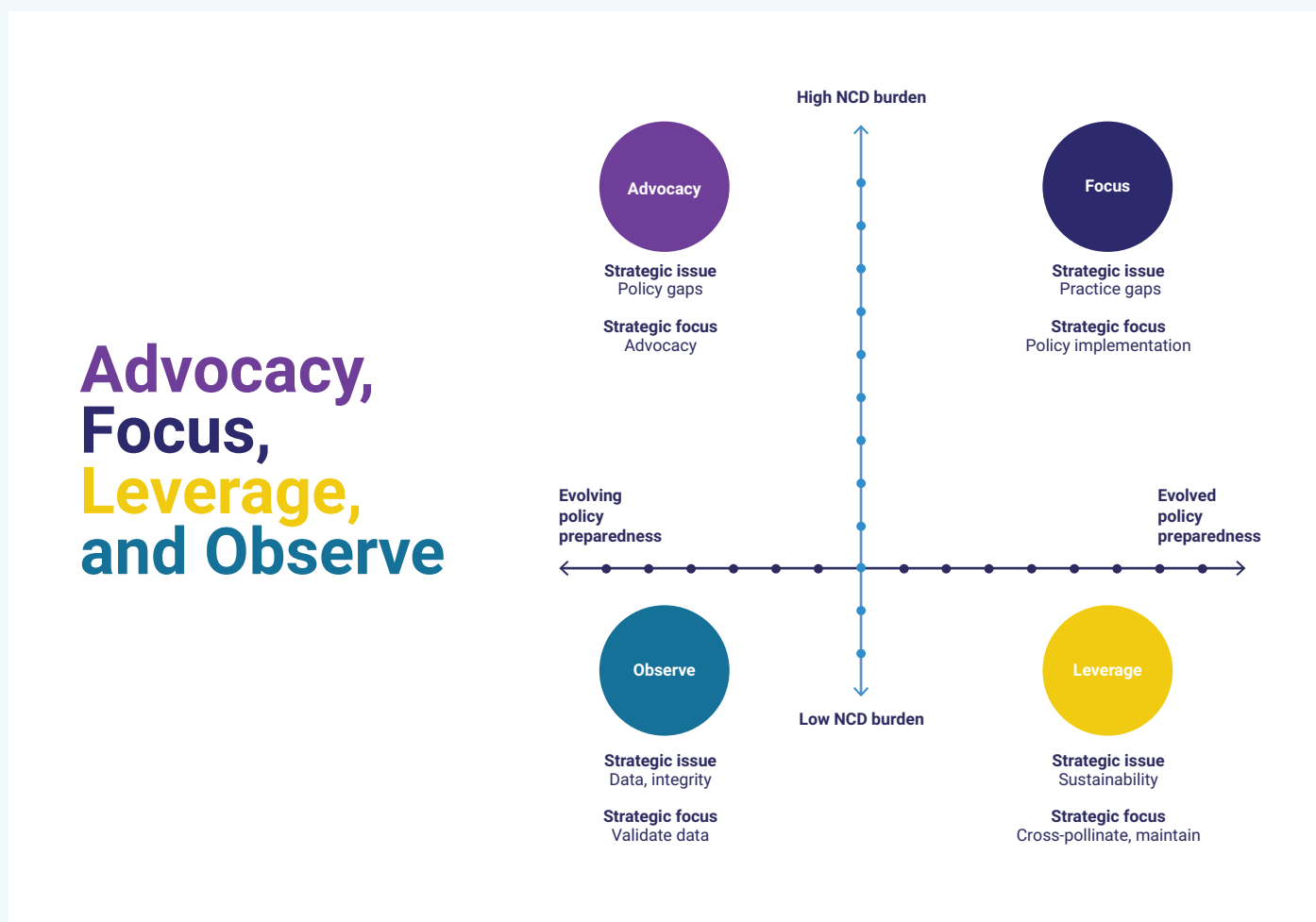
Viatrix Medical Affairs' activities in emerging markets are based around the three strategic pillars of Policy, Practice, and Patients. All initiatives in the emerging markets are anchored to each of these strategic pillars with the corresponding aims of addressing policy gaps in NCD management, optimizing management of NCDs and enhancing health system capabilities, and developing a people-centric approach.

### Policy: The SNAP framework

The Strategic segmentation for NCD country Action Plans (SNAP) framework was developed to determine market-specific intervention strategies that account for local NCD dynamics.

It groups countries based on multiple variables (from the Global Burden of Disease (GBD) study (209), WHO country profiles (210), and World Bank statistics (211), plus local data validation) to inform appropriate strategies. Using the SNAP framework, LMICs were segmented into four distinct groups based on the NCD burden of disease and policy preparedness: Advocacy; Focus; Leverage; and Observe (Figure 7). Each group defines priorities that should be applied when planning initiatives for countries in that group: 1) shaping policy in "Advocacy" countries; 2) improving clinical practice in "Focus" countries; 3) harnessing excellence in "Leverage" countries; and 4) maintaining a watch on "Observe" countries.

Figure 7. Quadrants of the SNAP framework in LMICs





## PRACTICE: REAL-WORLD EVIDENCE CENTERS OF EXCELLENCE

In many instances, national and local NCD policy recommendations are based on studies from HICs or adapted from evidence generated from communicable diseases (212). However, the applicability of international clinical practice guidelines in LMICs remains low due to limited choice, availability, and affordability of appropriate medications, and this contributes to suboptimal clinical management and inadequate control of chronic conditions such as hypertension (121, 213).

To be relevant in the local context, health policy and practice planning must prioritize co-creation of knowledge locally with active participation of both researchers and stakeholders who understand the decision-making environment (214). To address the research gaps in LMICs, Viatris set up two Centers of Excellence in partnership with academic institutions to train policy makers and study coordinators from the Middle East and Southeast Asia in real-world evidence research methodologies (215, 216).

**The New York University Abu Dhabi (NYUAD)-Viatris partnership** launched two key initiatives to support real-world evidence generation in the Middle East: 1) development of clinical research training modules for local researchers, thereby investing in capability enhancement; and 2) support the UAE Healthy Future

study, the largest prospective observational study conducted in Arab populations to establish the causes of and risk factors for chronic disease, through expertise building of NYUAD researchers and research dissemination activities (217).

**The Duke-National University Singapore (NUS) Medical School-Viatris partnership** established a real-world evidence training curriculum for policy makers and study investigators from the Association of Southeast Asian Nations (ASEAN) member states to standardize research methodologies across the region (217). The training curriculum is based on a systems thinking approach for the design and conduct of studies, which will enable policy makers to make evidence-based decisions for policy shaping (217).

### *Patients: Spotlight on Health literacy – Health Matters with Dr. Adam®*

An innovative partnership was forged between Upjohn and Emirates Airlines to improve public health literacy through a series of in-flight infotainment videos titled “Health Matters” with Dr. Adam®. These videos address health, wellness, and happiness. This program of NCD health promotion has a wide reach, with Emirates having 105,000 employees and carrying approximately 60 million passengers in 2018-2019. The partnership remained active in 2021, with new episodes added each month. Dr. Adam videos have since been adopted locally in Latin America and South Africa to help increase awareness of NCDs and their risk factors in these regions. Dr. Adam videos were also made for COVID-19 education.



## 6 NCD SOLUTIONS

### Key Points:

*NCD partnerships based on the concepts of “shared values,” mutual goals, localization, and knowledge translation can successfully drive concerted action to reduce premature mortality from NCDs and other related comorbidities*

*Adopting leadership in patient centricity as the core principle in decision-making will lead to better outcomes for patients living with NCDs, increased satisfaction, and reduced healthcare costs*

*Health equity or equitable and affordable access to healthcare is central to achieving the NCD targets in the SDG agenda and is influenced largely by socioeconomic determinants*

Investment in health, and specifically NCDs, is essential to allow countries to achieve many SDGs. The NCD solution requires a comprehensive approach, starting with a national NCD policy and frameworks for policy implementation, governance, and monitoring of interventions. Combined population-wide and individual approaches will help countries to achieve rapid gains toward the common goal of reducing NCDs.

Effectively putting these policies into action often requires localized, actionable tailored solutions to overcome a variety of implementation challenges. Health policy implementation is influenced by several factors, such as health financing, legislation, operating environment, advocacy initiatives, community mobilization, and health services organization and delivery.

The road map for devising NCD solutions is presented under the three Viatris pillars of Partnership, Leadership, and Access.

### 6.1 Partnership

The significant burden and complexity associated with NCDs make it nonviable for any single stakeholder to address the challenge alone. This can only be achieved through an ‘all-of-society’ approach, systematically combining the power and reach of all sectors. Hence, Viatris partners with a diverse group of stakeholders, ranging from governments, local organizations, professional bodies, and regional organizations to strengthen evidence generation, promote health literacy, and improve NCD care delivery.

Partnerships based on the concept of shared value (i.e., focused on the cusp of societal and economic progress) have the potential for generating greater innovation and growth for companies as

well as greater benefits for society. Localization of partnerships by engaging with regional partners for agenda setting and implementation increases the impact of the partnership, perhaps by contributing toward shared value. Engaging with multiple stakeholders to effectively target NCDs at a local level requires knowledge translation defined as “the synthesis, exchange, and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people’s health” (13).

To alter the current trajectory, it is essential to overcome the silo-based approach to treating NCDs and progress toward a unified “whole-of-government” and “whole-of-society” agenda. Involvement of partners from government, national/international organizations, private sector, academia, and CSOs across different sectors (e.g., health, education, agriculture, finance, environment) is strongly recommended to catalyze awareness efforts, establish mutual goals, optimize resources and avoid redundancies for effective planning and implementation of NCD programs. Partnerships are critical because they generate synergies through service coordination and provide value-based care in the right setting, thereby extending the continuum of care.





## NCD ACADEMY (GLOBAL)

The NCD Academy – a joint project by Viatris, the American College of Cardiology, the NCD Alliance, and the World Heart Federation – is a first-of-its-kind collaboration between major players in global health to equip frontline health workers with integrated, mobile-first, free-of-cost education on NCD care as they take on a more prominent role in prevention (218). The goal of the NCD Academy is to fill the “know-do” gaps by facilitating the provision of comprehensive NCD management by primary care providers and community health workers, and foster progress toward achieving United Nations (UN) SDGs.

The Academy currently offers courses on CVD and stroke prevention, oncology, and mental health (in collaboration with the World Psychiatric Association), and a special course on COVID-19 and its impact on NCDs. These are currently available in multiple languages (including English, Chinese, Spanish, Portuguese, and Italian), with more to follow (such as Japanese, Korean, Russian, and French). For example, local medical colleagues are collaborating with primary care/national cardiology societies such as Italian Society of Cardiology, SEFAC Spain, British Royal College of GPs, CONAMEGE Mexico, Emirates Cardiac Society, Saudi Heart Association, National Heart Association Malaysia, SBC Brazil and CSC China to implement courses on CVD and stroke prevention (219). In 2021, the NCD Academy had more than 7,000 new individual users from more than 100 countries. Future courses are planned on diabetes (in partnership with the American Diabetes Association), chronic respiratory diseases, and social determinants of health.



## *International Alliance of Patients' Organization (IAPO) Partnership (Global)*

Viатris has collaborated with IAPO with the goal of building a sustainable patient-centered approach to the care of NCDs, establishing a framework for cooperation to understand the patient voice, exploring advocacy opportunities to positively impact the patient journey, and pursuing opportunities that benefit and leverage the missions of both organizations.



## 6.2 Leadership

Patients are becoming increasingly engaged with their healthcare decisions due to enhanced access to healthcare information. A patient-centric approach involves and enables participation of the patient in their own care. Also referred to as person-centric or people-centric, this integrated approach combines the expertise of HCPs with feedback from patients and their families. The WHO also recommends a framework on people-centered health that shifts the focus from diseases to putting the needs of people at the center of health systems (220). The WHO notes that such a framework can result in improved access to care, improved outcomes, better health literacy and self-care, increased satisfaction with care, improved job satisfaction for health workers, and reduced costs (220).

This patient-centric approach is progressively being recognized as a way to make decisions for the patient that are evidence-based and responsive to patient preferences, needs, and values, and that will result in the best outcomes. In striving for a more patient-centric approach, it is important for health systems to make decisions based on data-driven insights. Providing reliable local data on the patient journey has benefits not only for patients, but also HCPs and health service managers.

While patient journeys for NCDs, including awareness, screening, diagnosis, treatment, adherence, and control or remission are documented in developed countries, they remain less well understood in LMICs (92).

### *Patient Empowerment: NCD Web Platform (Developed Markets)*

To address the challenge of prevention and continuity of care for the NCD patient community, Viatris is supporting the EIP on AHA to develop a “holistic” web platform for patients from the UK and Italy. The platform will include institutional, validated, and accessible health information from NCD experts, including information targeted to addressing the issues of chronic disease prevention, lack of adherence to therapies, integrated care, frailty, and lifestyle. This educational digital health resource is designed to provide patient empowerment and will improve the health outcomes and increase longevity of NCD patients.

### *MAPS Initiative (Emerging Markets)*

Mapping the Patient Journey Towards Actionable Beyond the Pill Solutions (MAPS) initiative by Viatris is part of our commitment to help reduce premature mortality from NCDs by one-third, facilitating the attainment of SDG health targets (10, 221). The MAPS initiative recognizes that a patient-centric approach is required to generate rational scientific recommendations to our cross-functional strategic planning process. This will ultimately deliver actionable “beyond the pill” solutions tailored to the needs of patients. It is useful to consider the patient journey based on local evidence to understand these needs and inform strategies (92). The MAPS framework enables local officials in 12 LMICs to draw on epidemiological data and real-world insights along the NCD patient journey. When applied at touch points along the patient journey, these solutions can improve awareness to better engage patients to predict and prevent risk factors that lead to negative health consequences. The methodology for MAPS (10), as well as local data in select LMICs (222), have been published in peer-reviewed scientific journals.

### *China Public Health Media Education Program (CHEER) (Greater China)*

The goal of the China Public Health Media Education Program (CHEER) is to educate the public and the media about health literacy. This health education program is supported by Viatris in collaboration with the China National Health Commission Propaganda Department, China National Health Commission Disease Control Bureau, China Health Education Center, and China Journalists Association. As a long-time sponsor of the program, Viatris has focused on management of NCDs, and was recognized in 2020 with the Public Health Education Facilitation Award.





### 6.3 Access

One important aspect of access to healthcare is health equity, which includes the socioeconomic determinants of health. Action on these factors is essential for inequities in NCDs to be addressed, which, in turn, is required for effective action on NCDs (223). As recently stated by The Lancet NCD and Injuries (NCDI) Poverty Commission, “Recognizing that the dignity of the human person is fundamental, we wish to see the goals and targets met for all nations and peoples and for all segments of society” (224).

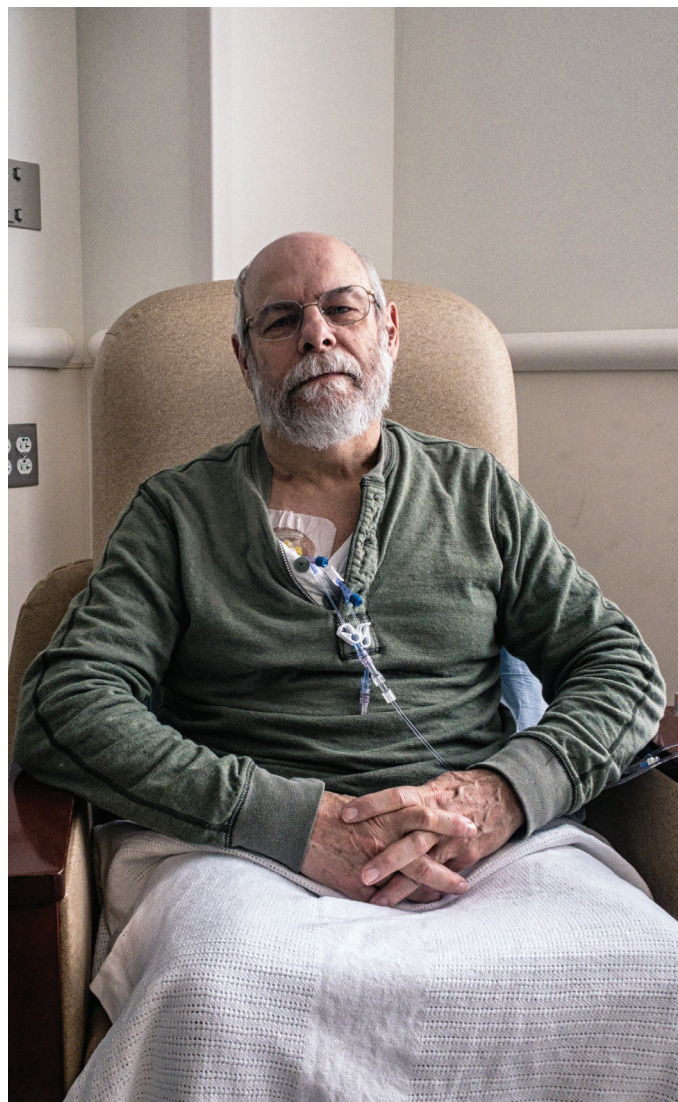
#### *Biosimilars*

Treatment of debilitating and life-threatening diseases often combine innovative treatment options with biologics. Biosimilars are manufactured to closely resemble the originator or reference biologic product (225, 226). Biosimilars undergo extensive analytical, structural, and functional comparisons with the reference product, comparative pre-clinical studies, clinical pharmacokinetics (PK), pharmacodynamics (PD), and immunogenicity, and usually comparative clinical efficacy and safety assessments, prior to their approval. A biosimilar has no clinically meaningful differences from the reference product and can be used as an alternative to the reference product (227).

**Pharmacoeconomic impact:** When treatment with a biological product is prescribed, the availability of biosimilar medicines can expand treatment options available to patients, potentially lowering healthcare costs and increasing access to optimal treatment (227). Budget impact analyses have shown that use of biosimilars for the treatment of autoimmune diseases could increase patient access and substantially reduce costs (228, 229). A UK analysis of rheumatology specialties from 2014 to 2017 found that the introduction of infliximab and etanercept biosimilars was associated with a saving of £38.8 million over two years (230). In the field of oncology, it has been suggested that the availability of biosimilars is fundamental to the ability to deliver sustainable and universal healthcare (231). A systematic review of data on oncology biosimilars suggested that the use of biosimilars could improve the efficiency of health resource allocation and help control budgets while expanding medical access (232). However, currently available data were limited and largely confined to Europe and the US (232, 233).

**Biosimilars in oncology:** Biologic drugs are key components of modern cancer treatment regimens (234), and are recommended for the treatment of a variety of cancers due to their beneficial effects on clinical outcomes, including survival (235, 236). A drug expenditure analysis conducted in 2011 showed that biologics accounted for more than half of all expenditures on antineoplastic drugs in the US healthcare system; of these bevacizumab (for colorectal, brain, lung, fallopian tube, renal, and other cancers), rituximab (for CD20-positive non-Hodgkin lymphoma and leukemia), and trastuzumab (for HER2-positive breast cancer) accounted for more than half of the top 20 antineoplastic expenditures in outpatient clinics (234, 235, 237, 238).

Up to the end of 2019, a total of 262 biosimilar agents had been approved in 40 countries, and oncology biosimilars accounted for almost half of these (63 anticancer biosimilars and 66 cancer supportive agents) (239). This shows the potential for oncology biosimilars to provide access to effective treatment options for patients with cancer, as recognized by the American Society of Clinical Oncology (240).



**Biosimilars in diabetes:** Although insulin was discovered more than a century ago, access to this life-saving therapy for patients with diabetes is limited. This is particularly the case in LMICs (241), but is also an issue in HICs like the US (242, 243). The availability of insulin therapy is especially relevant given that the number of adults living with diabetes has quadrupled since 1980, to 422 million adults, largely due to the rise in type 2 diabetes driven by risk factors such as overweight/obesity (244). In 2012 alone, diabetes caused 1.5 million deaths, and diabetic complications contribute to the development of CVD, stroke, kidney failure, blindness, and peripheral vascular disease (244). In 2019, the WHO launched a prequalified program for biosimilar insulins to boost access to human insulin products (245).

**Biosimilars in chronic, immune-mediated inflammatory diseases:** Biologic therapies have transformed the treatment of immune-mediated inflammatory diseases (IMIDs) such as RA and IBD (246-249). As for other diseases treated with biologics, use of these agents in immunological conditions is limited by the high cost of therapy (250). Even within Europe there is wide variability in the uptake of biologic agents among patients with RA (251). Factors associated with lower use of biologics included lower socioeconomic status of a country, stricter rules for prescription and reimbursement of biologics, and worse affordability of biologics (251). Lack of, or inability to, access biologics is especially relevant for some immunologic conditions, such as RA, where early treatment can influence the subsequent disease course (252).





## 7 NCDs AND DIGITAL HEALTH

### Key Points:

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*Leveraging digital healthcare will help countries provide equitable, sustainable, scalable healthcare*

*The COVID-19 pandemic accelerated the adoption of digital healthcare to meet the needs of patients with NCDs and their providers faced with disrupted healthcare services*

*Digital tools and services have the potential to empower individuals, build healthier societies, and also have several potential applications across all phases of the NCD patient's disease management journey*

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The COVID-19 pandemic caused a sudden disruption in delivery of healthcare around the world, including NCD management. This led to a substantial global impetus for the development, use, and promotion of digital solutions for NCD management (253). The WHO has stated that digital health will help achieve SDGs, and should be an integral part of health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable, and sustainable (254).

In addition, the availability of digital health tools and solutions is reshaping the relationship between physicians, patients, and the healthcare system, and allows patients to play a more active role in their own health (255, 256).

The WHO's global strategy on digital health aims to support and respond to the growing needs of countries to implement appropriate digital technologies in accordance with their health priorities and to make progress toward universal health coverage and the health-related SDGs. Other world bodies, such as the International Telecommunication Union, along with national and regional (state) government health bodies and public-private partnerships, are also involved in the development of a variety of digital solutions, including home-based services, mobile apps, internet-based services, data and computing clouds, artificial intelligence (AI), gamification, screening tools, and decision support systems (257). These digital tools have a variety of potential applications across all phases of the NCD patient's disease management journey, including awareness, screening and diagnosis, treatment, adherence and monitoring, and control or remission (Table 3).



Table 2. Potential applications of digital interventions across the NCD patient management journey

Phases of the NCD Patient Journey	Artificial Intelligence (AI) and Machine Learning (ML) Tools	Mobile-Based (mHealth) and Web-Based Tools	IoMT (Internet of Medical Things) Tools
Awareness	<ul style="list-style-type: none"> <li>• AI-based apps monitor smoking patterns, mood patterns, quitting goals to help in smoking cessation</li> </ul>	<ul style="list-style-type: none"> <li>• Provider-to-provider communication, training of frontline health workers for health education, and screening of targeted population</li> <li>• Diet, exercise, and health promotion apps</li> <li>• Online health communities, patient groups, and expert groups</li> </ul>	<ul style="list-style-type: none"> <li>• Google- and Apple-based mobile devices have linked up with smart watches and fitness bands and connect with multiple health apps to provide health information and promote physical activity</li> </ul>
Screening	<ul style="list-style-type: none"> <li>• AI-based robot/Chatbots recognize and categorize patients based on disease severity</li> <li>• AI-based early warning scores analyzes EHR data to screen individuals at risk</li> </ul>	<ul style="list-style-type: none"> <li>• Social media and search engine using digital trails to educate and promote helplines for mental health disorders</li> </ul>	<ul style="list-style-type: none"> <li>• Wearable devices detect early disturbances in heart rate, sleep patterns and electrocardiogram (ECG) changes</li> </ul>
Diagnosis	<ul style="list-style-type: none"> <li>• AI-based radiological and pathological screening and diagnosis of lung diseases, cancers, and neurological conditions</li> </ul>	<ul style="list-style-type: none"> <li>• E-diagnostics scheduling and reporting</li> <li>• iPad + game-based solutions to diagnose dementia and early cognition decline</li> </ul>	<ul style="list-style-type: none"> <li>• Smart Pills provide information about GI tract conditions, core temperature</li> </ul>



<p><b>Treatment</b></p>	<ul style="list-style-type: none"> <li>• AI-based genetic profiling for precision medicine</li> <li>• Data mining for population-selective interventions in oncology</li> <li>• Clinical decision support systems in oncology and other NCDs</li> <li>• Robotic surgeries and radiotherapy tools deploy AI tools from image analytics to operate precisely in general and cancer surgeries</li> <li>• ML-based patient triaging</li> <li>• AI-based healthcare processes automation for scheduling and optimizing healthcare delivery</li> </ul>	<ul style="list-style-type: none"> <li>• Synchronous (tele- and video consulting) and asynchronous telemedicine</li> <li>• Electronic pharmacy: purchase, approval, and refill of medications through apps</li> <li>• Smart insulin pumps + CGMS connected to mobile apps</li> <li>• Virtual reality-based games used for cognitive behavioral therapy for attention-deficit/hyperactivity disorder, anxiety, pain and phobias, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Chatbot + ODL-based mobile apps connected/not connected with wearable devices to monitor disease, e.g., Wysa and Woebot for depression and anxiety, providing virtual CBT</li> <li>• Remote monitoring in healthcare facility through apps connected to HCPs, such as monitors of home BP, oxygen, ECG, seizures, and CGMS</li> </ul>
<p><b>Adherence</b></p>	<ul style="list-style-type: none"> <li>• Data mining of EHRs to predict individuals with poor adherence and/or complex comorbidities for follow-up digital health interventions</li> <li>• AI-assisted medication reconciliation tools to check counterfeit medications and reduce medication errors</li> </ul>	<ul style="list-style-type: none"> <li>• Mobile device/image/video AI-based monitoring of adherence by identifying patient, drug and method of taking medication</li> <li>• AI Chatbots using NLP to impart disease and medication information to increase adherence,</li> <li>• Dose reminder apps for increasing adherence and to provide medical information assistance</li> </ul>	<ul style="list-style-type: none"> <li>• Smart inhaler helps in monitoring respiratory distress patterns and monitors adherence and inspiratory flow</li> </ul>
<p><b>Control or Remission</b></p>	<ul style="list-style-type: none"> <li>• AI Chatbots to assist patients in providing answers to various queries around disease, medications, and self-care</li> </ul>	<ul style="list-style-type: none"> <li>• Digital therapeutics solutions using NLP (AI &amp; ML), ODLs and connected smart devices to precisely deliver individualized care to patients in oncology, psychiatry, diabetes, cardiovascular, gastroenterology, etc., and monitor improvements in condition</li> </ul>	<ul style="list-style-type: none"> <li>• Virtual reality-based solution for physical rehabilitation after a stroke</li> <li>• Smart home-based spirometers connected with mobile app helps facilitate understanding of respiratory disease severity and response to medications, allowing delivery of precise treatment</li> </ul>

BP, blood pressure; CBT, cognitive behavioral therapy; CGMS, continuous glucose monitoring systems; EHR, electronic health record; GI, gastrointestinal; HCPs, healthcare professionals; NLP, natural language processing; ODL, observations of daily living.

## VIATRIS DIGITAL THERAPEUTICS:

### Beyond-the-Pill Digital Tool for Hypertension Management

An app-based tool connecting Bluetooth-based BP monitors has been piloted in the Greater China region in over 25,000 patients. The app facilitates:

1. BP chart visualization on HCPs' dashboard; monitoring, reminder, and notification of high BP to patients;
2. Medication reminders and records to increase adherence and compliance;
3. Lifestyle improvement recommendations with 10 weekly individualized articles and tips, plus an exercise and diet prescription; and
4. Support for caregivers by helping them to understand and inform patients about timely BP measurement and medication taking, and to assist them in communicating with HCPs.

This highlights the global urgency to advance health equity for vulnerable populations, something that can only be achieved when we collectively address health structures and systems. Prioritizing NCDs should be considered an investment with economic gains that can be calculated in dollars saved, increased productivity, and overall economic growth. Integrated care can provide a way to effectively address both NCDs and infectious diseases like COVID-19, and it also has the potential to produce efficiencies in healthcare delivery—for instance, by providing care for multiple conditions using the same human resources and primary care platforms.

Innovation in evidence-based approaches is essential to improving population-based health strategies for NCD prevention and management. Our approaches should be centered around community-engaged, multidisciplinary, and multisectoral relationships to prevent and manage NCDs globally. In addition, collective sharing and learning must be strengthened and expanded to inform policy, transform systems, and contextualize strategies so that interventions are responsive to both individual and structural changes and sustainable.

Affordable, life-saving interventions exist to address many of the health challenges we face, including NCDs. However, effective implementation of proven healthcare solutions in the real world is a key challenge. Failure to effectively implement solutions has a high price in terms of preventable and treatable deaths. Implementation research highlights a range of factors including “real world” contextual elements that are either overlooked or not captured by other research disciplines. Implementation research provides the kind of context-specific and evidence-informed decision making that is crucial to making what is possible in theory a reality in practice.

## 8 A WAY FORWARD

The COVID-19 pandemic has highlighted the cumulative burden that NCDs place on individuals and health systems, both in terms of morbidity and mortality. The occurrence of “long COVID” in a proportion of patients who have been infected with the SARS-CoV-2 virus could create new long-term disabilities that will add to a growing NCD burden (258). The pandemic has also laid bare the intersection of chronic diseases with infectious diseases, disproportionately affecting those with pre-existing NCDs and those from historically disempowered communities.





## 9 ABBREVIATIONS

<b>AI</b>	Artificial intelligence
<b>ASCVD</b>	Atherosclerotic cardiovascular disease
<b>BP</b>	Blood pressure
<b>CDC</b>	U.S. Centers for Disease Control and Prevention
<b>COPD</b>	Chronic obstructive pulmonary disease
<b>CSOs</b>	Civil society organizations
<b>CVD</b>	Cardiovascular disease
<b>DALYs</b>	Disability-adjusted life years
<b>EIP on AHA</b>	European Innovation Partnership on Active and Healthy Ageing
<b>GBD</b>	Global Burden of Diseases, Injuries, and Risk Factors Study
<b>HCPs</b>	Healthcare professionals
<b>HICs</b>	High-income countries
<b>IAPO</b>	International Alliance of Patients' Organization
<b>LMICs</b>	Low- and middle-income countries
<b>MAPS</b>	Mapping the Patient Journey towards Actionable Beyond the Pill Solutions
<b>MDD</b>	Major depressive disorder
<b>NCDs</b>	Non-communicable diseases
<b>SARS-CoV-2</b>	Severe acute respiratory syndrome coronavirus 2
<b>SDGs</b>	Sustainable Development Goals
<b>SNAP</b>	Strategic segmentation for NCD country Action Plans
<b>QoL</b>	Quality of life
<b>UAE</b>	United Arab Emirates
<b>UN</b>	United Nations
<b>WHO</b>	World Health Organization

## 10 REFERENCES

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