Leading the Conversation on Noncommunicable Diseases Worldwide: An Evidence-Based Review of Key Research and Strategies to Develop Sustainable Solutions

2020

NCD WHITE PAPER

Pfizer Upjohn
A Pfizer Division

Executive summary

Every two seconds, someone dies prematurely from cardiovascular disease, cancer, diabetes, chronic respiratory disease, and other chronic conditions collectively known as noncommunicable diseases (NCDs). In fact, NCDs are now the leading cause of death and morbidity globally, with 71% of all deaths attributable to these conditions. NCDs overtook infectious diseases as the leading cause of death globally in 2015, but this has been a creeping crisis for several decades.

NCDs are not selective; they affect men and women in all countries and all socioeconomic classes, albeit with notable regional differences that influence intervention strategies and outcomes. Further amplifying the crisis, the high prevalence and chronic nature of NCDs have a direct impact on economies, with the total global burden estimated to reach US$47 trillion between 2010 and 2030.

The past seven years have witnessed an unprecedented global political commitment to NCD prevention and control, culminating in the inclusion of NCD targets in the United Nations Sustainable Development Goals. Specifically, country targets have been issued to reduce global NCD-related mortality by 30% by 2030. Important milestones have been achieved in recent years, though rates of success remain uneven and often off track across population segments, contributing to an ethical dilemma regarding how to prioritize and allocate resources for intervention.

Parallels can be drawn between the emerging NCD crisis and the HIV movement of the late 20th century. To this end, we should be turning to the HIV movement as a case study for NCD intervention. Patient fear and anger led to inter-sectoral involvement using nonconventional solutions and made HIV a priority on the global agenda. In particular, integrated care leveraged a patient-centric approach to positive health outcomes, galvanizing an entire healthcare ecosystem around one aligned goal. Today, HIV, once a death sentence, is now a chronic disease.

In contrast, the NCD movement lacks the same groundswell of resolute stakeholders striking at the problem from all angles. Quoting Richard Horton, Editor-in-Chief of *The Lancet,* "The NCD movement is too quiet, too pedestrian, and too polite to make the impact it deserves." To effectively catalyze action around a crisis as complex and wide-sweeping as NCDs, no one can afford to be a bystander; we need to get loud and hold all sectors accountable for a deliberate, radical solution. No one sector can do it alone. It is time for multilateral organizations, academia, governments, civil society organizations, healthcare providers, and the private sector to step up in unison with a new level of urgency and impatience to curtail this soaring public health epidemic.

Embracing the role of the private sector, Pfizer launched Upjohn as a division dedicated to the fight against NCDs through a focused, strategic, and collaborative approach across the healthcare value chain. We work toward these goals using broad-based efforts to engage multiple stakeholders and contribute to long-term capacity building. Patients are at the core of Upjohn's work—and the patient care journey informs our efforts at every turn. We believe that a validated, evidence-based approach to prevention and treatment is essential to shifting health outcomes and enabling patients to live longer, healthier lives, thus serving our mission of

relieving the burden of NCDs with trusted, quality medicines for every patient, everywhere.

Contents

Abbreviations

AfME – Africa and the Middle East
ASC – Argentina Society of Cardiology
ASEAN – Association of Southeast Asian Nations
CDC – Centers for Disease Control and Prevention (US)
COPD – chronic obstructive pulmonary disease
CSO – civil society organization
CVD – cardiovascular disease
DALY – disability-adjusted life year
GBD – global burden of disease
GNI – gross national income
HCP – healthcare professional/provider
HICs – high-income countries
HTN – hypertension
LatAm – Latin America
LMICs – low- and middle-income countries
MDD – major depressive disorder
MLO – multilateral organization
NCD – noncommunicable disease
PCP – primary care physician
PPP – purchasing power parity
SDG – Sustainable Development Goal
SNAP – Strategic Segmentation for NCD Country Action Plans
UKPRP – United Kingdom Prevention Research Partnership
UN – United Nations
WHO – World Health Organization

Scope and usage of this document

NCDs have been extensively portrayed in various public domains. This white paper represents Pfizer Upjohn's perspective on the NCD crisis as supported by underlying evidence and publications. It is intended to be used as an illuminating resource on NCD burden, primary causes, and intersectoral strategies to mitigate the toll of disease.

Acknowledgments

This first edition white paper on NCDs is the culmination of contributions from multiple colleagues and teams at Pfizer Upjohn. We would like to acknowledge the lead authorship of Lobna Salem, MD, MSc, Alex Cleveland, Drew Lewis, MD, MTM&H, FACP, Shekhar Potkar, MD, MSHS, and Kannan Subramaniam, MD, and the contributions of the many colleagues who provided their scientific perspectives and support.

We are grateful to the institutions and thought leaders whose individual and collective research efforts have been referenced to underpin the foundations for this paper.

Buoyed by the spirit of partnership, we offer this contribution of experience and scientific insight as a resource for all readers motivated to bring progress in the impact that we can collectively make on noncommunicable diseases and public health.

Sincerely,

Amrit Ray, MD

Global President, Research, Development & Medical, Pfizer Upjohn

January 2020

01
Purpose

This white paper leverages data published by a cross-section of authorities to provide the reader with an evidence-based summary of the current state of play for noncommunicable diseases (NCDs)—the causes, major trends, and methods of effective intervention. This is a single resource that compiles evidence in one place to help further identify solutions, propose a framework to implement action, and thereby relieve the burden of this public health crisis.

This white paper is also intended to rally us all around a renewed call to action—to stand up and transfer our collective knowledge across sectors into tangible results. It's a call to join a movement to make everyone's lives healthier, more empowered, and more fulfilled, for longer. It's a call to stand up united and relentless to take on one of the biggest threats to public health today.

Key points	
	NCDs are the biggest contributors to mortality worldwide.
	NCDs are a major cause of morbidity and disability.
	The global economic burden of NCDs is immense and growing.

02
NCD burden

Before interventions designed to reduce the impact of NCDs can be conceived, a detailed understanding of their burden is required. This section outlines the burden, describing contemporary information on NCD mortality and morbidity and the associated economic impact.

Morbidity is defined by the National Cancer Institute as “having a disease or a symptom of disease, or to the amount of disease within a population. Morbidity also refers to medical problems caused by a treatment.”

The distinct but related term "disability" is defined by the WHO as “an umbrella term, covering impairments, activity limitations, and participation restrictions. An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations.”

Morbidity is a precursor to disability and can exist on its own whereas NCD-related disability is always accompanied by at least one presenting morbidity.

a

Mortality

NCDs account for 71% (41 million) of global deaths each year (Figure 1).[1] Nearly 44% are attributable to cardiovascular disease (CVD), including stroke and ischemic heart disease; 22% to cancer; 9% to chronic respiratory disease;* and 4% to diabetes (Figure 2).[1] Around 30% of these deaths are premature, occurring before the age of 70 years.[2-4]

Much of this premature death is preventable and treatable through multifaceted intervention strategies that can begin with early education. Notably, adolescence has been described by the Population Reference Bureau as the "last best chance" to establish positive and enduring health habits. Given (1) the world population of people aged 10–24 years is at its largest in history at 1.8 billion, (2) 1.5 billion reside in developing markets, and (3) this age group is generally influenced by peers, parents, and targeted marketing, this population could prove extremely vulnerable to preventable conditions or highly successful at galvanizing around a healthy future.[3]

CVD is often categorized as a disease of wealthy, industrialized societies. Yet with increased urbanization changing lifestyles over the years, over 75% of CVD-related global deaths occur in low- and middle-income countries (LMICs).**[5] Looking into high-income countries (HICs), cancer is particularly prevalent in Europe: with one-eighth of the world population, it has one-quarter of all cancer cases.[6]

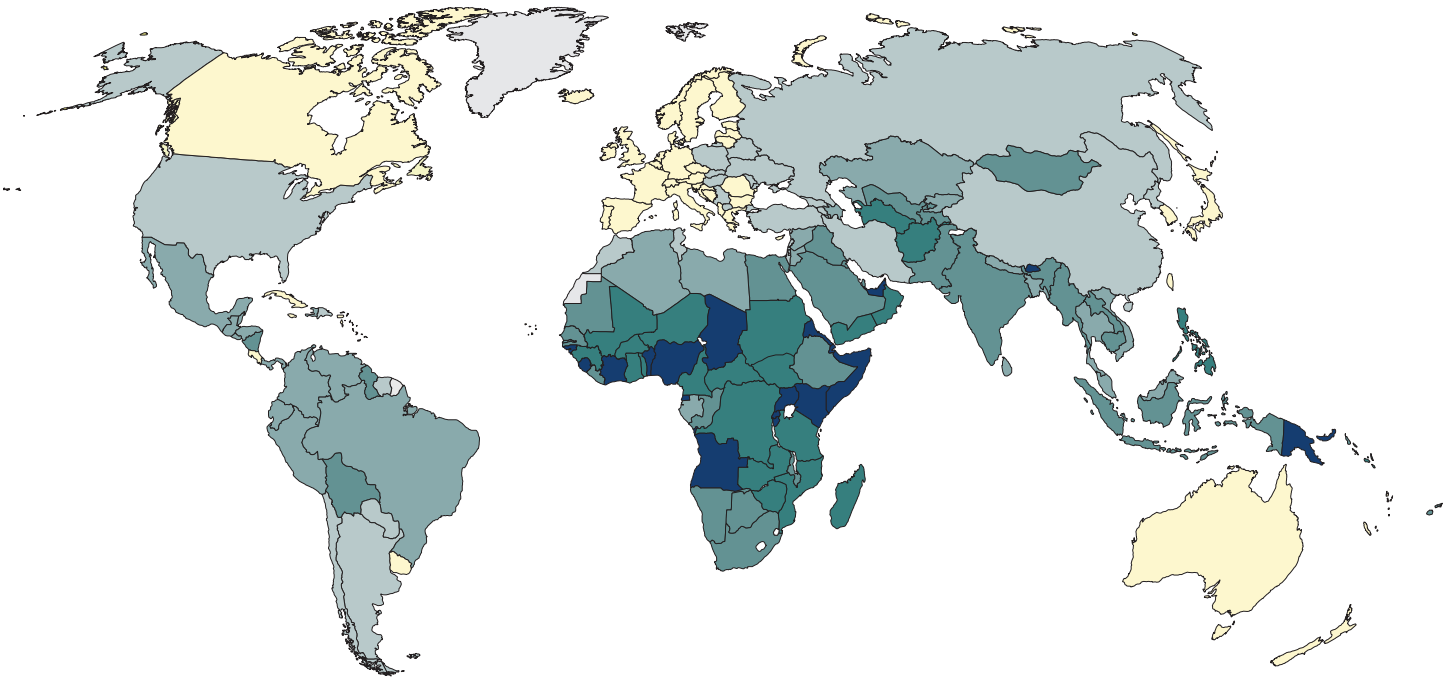
Three hundred million people have chronic respiratory diseases worldwide, and this number is increasing.[7] Likewise, the number of people with diabetes has increased nearly fourfold since 1980.[8]

> *Someone aged 30–70 dies prematurely from an NCD every two seconds.*
>
> World Health Organization. Noncommunicable diseases (NCDs) and mental health: Challenges and solutions.[9]

*The World Health Organization (WHO) mostly refers to chronic respiratory disease as chronic obstructive pulmonary disease (COPD).

**LMICs are defined by the World Bank as a gross national income (GNI) per capita of ≤US$12,375. High-income countries (HICs) are defined by the World Bank as having a GNI of ≥US$12,376 per capita. HICs broadly align with what Upjohn defines as developed markets. LMICs are defined as emerging markets for Upjohn.
Upjohn developed markets are North America, Europe, Japan, Korea, Australia, and New Zealand.
Emerging markets are the ASEAN/India/Pakistan, AfME, and LatAm regions.
Greater China includes China, Hong Kong, and Taiwan.
A full list of countries and their GNIs is available at: https://data.worldbank.org/indicator/ny.gnp.pcap.pp.cd[10]

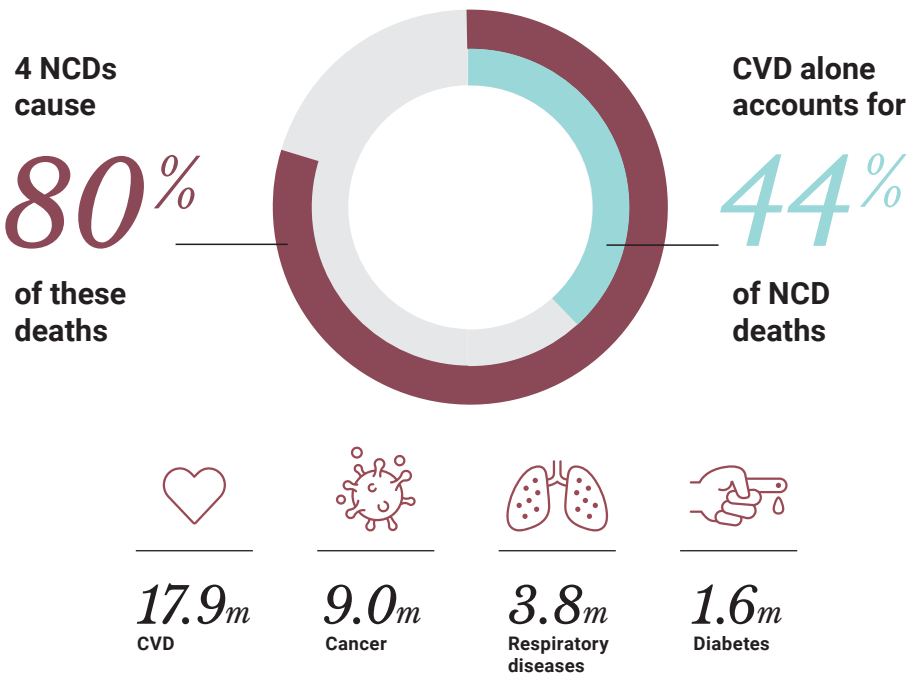
Figure 1. **NCD-related mortality under the age of 70 years (2015)**



NCDs are responsible for 71% of all deaths worldwide. This translates to *41 million people* each year.

Adapted from WHO: Global Health Observatory data; WHO: NCD mortality and morbidity and global status report on NCDs[1,11]

Figure 2. **NCD-related mortality by major cause[8]**



b

Morbidity and disability

NCDs are a major cause of morbidity and disability. Conditions such as anxiety, depression, pain, and mobility impairment place a significant burden on social welfare and healthcare systems.[12] Such conditions can lead to a sedentary lifestyle, further increasing a predisposition toward NCDs such as CVD and diabetes. Mental health conditions, chronic respiratory disease, arthritis, and CVD have the largest negative impact on quality of life compared with other chronic diseases due to their symptomatic and disabling nature.[13-15]

Actions to monitor NCDs have gained momentum, but developments in managing associated NCD-related disability have been relatively slow.[16,17] The standardized way of measuring the impact of disability is by calculating disability-adjusted life years (DALYs)—one DALY is the sum of years of life lost from premature death and years lived with disability.[18] DALYs portray the total years of healthy life lost from all causes. Investigating DALYs can uncover health problems in a population—such as the death of people at a very young age, the shortening of lives by a few years in many people, or long-term morbidity for many people.

The NCDs associated with the greatest morbidity and disability burden differ from those responsible for greatest risk of mortality. For example, mental illness and chronic pain are now recognized as key drivers of NCD-related morbidity and disability, but are not considered to be major direct contributors to mortality.[19-25]

Mental health and neurological conditions

Mental health and neurological disorders such as major depressive disorder (MDD), anxiety, schizophrenia, bipolar disorder, and dementia cause significant morbidity. These conditions share many of the same determinants and consequences as the major NCDs. They account for 37% of DALYs for NCDs,[19] with MDD the leading cause in 56 countries.[20,21] This has been specifically recognized by the United Nations (UN) in its reference to mental health and well-being in Sustainable Development Goal (SDG) target 3.4.[22] In recent years, a renewed interest in the relationship between MDD and mortality has been driven by the dramatic rise in both the prevalence of MDD and rates of suicide. (see Spotlight on MDD, Page 14)

Chronic pain

Lower back pain is a leading cause of disability globally.[23] It is estimated that 20% of adults worldwide suffer from pain, and 10% of adults are newly diagnosed with chronic pain each year.[23-25] The largest causes of pain are cancer, osteoarthritis, rheumatoid arthritis, operations, injuries, and spine-related conditions. Chronic pain has many downstream consequences that can include depression, problems with social relationships, inability to work and, in some cases, suicidal thoughts.

C

Comorbidity

NCDs are often interrelated, with the primary disease making it more likely a patient will develop other NCDs (comorbidity); in many cases, there is an underlying pathophysiology. For example, approximately 75% of adults with diabetes also have hypertension, and up to 40% of adults with diabetes have at least three NCDs, creating a complex set of health issues impacting the patient's quality of life.[26,27] Mental health conditions in particular often occur with other NCDs.[21,28-31] Although there is an association between increasing age and comorbidity, they can occur at any age.[23]

For example, approximately 75% of adults with diabetes also have hypertension, and up to 40% of adults with diabetes have at least three NCDs, creating a complex set of health issues impacting the patient's quality of life.[26,27]

Similarly, the economic burden in China due to the five main NCDs is large, totaling US$27.8 trillion between 2012 and 2030.[34] The Chinese government is taking action by targeted governance, robust surveillance, expanded research, and education. For populations at high risk, education on grassroots, comprehensive interventions is the most effective solution and includes early detection and management of NCDs by healthcare providers and partners.[35]

d

Economic burden

NCDs affect economies in at least three ways:

1. Working-age individuals with a chronic NCD are often less productive, have higher rates of absenteeism, and retire early, therefore reducing their output.
2. Premature death results in a direct loss to the country's work output and the family's economic status.
3. NCD interventions divert resources that could otherwise be used for productive investments (e.g., infrastructure), leading to a loss of savings across the population and disrupting capital accumulation.[32]

The economic burden of NCDs continues to increase, with mental health conditions and CVD imposing the highest financial burden.[32] It has been estimated that a cumulative US$47 trillion in economic output will be lost to NCDs between 2010 and 2030.[19] In the United States alone, costs of managing chronic diseases are projected to total US$4.2 trillion yearly by 2023.[33] With a growing prevalence of disease and constrained resources, healthcare costs may keep patients from gaining access to essential medicines and basic technologies.

US$47

trillion

in economic output will be lost to NCDs between 2010 and 2030.[19]

Cost of managing chronic disease could total

US$4.2

trillion

in the US alone by 2023.[33]

SPOTLIGHT
on major depressive disorder

MDD has a proven 52% increased risk of excess mortality,[36] and around 15% of MDD patients will die by suicide.[37] Suicide accounts for almost 800,000 deaths per year worldwide and is the second-highest cause of death among those aged between 15 and 29 years.[38-40]

To help reverse the worldwide increase in suicide, targeted healthcare resources are needed. Globally, fewer than half of those affected by MDD (in many countries fewer than 10%) receive effective treatment.[38,40] The main barriers to care include a lack of resources, inaccurate diagnosis, and social stigma associated with mental illness.[40,41]

Primary care has a critical role in the treatment of MDD. If patients are monitored carefully and treatment interventions are stepped up if the initial response is not achieved, results can be successful—markedly improving patient satisfaction and health outcomes.[42]

Addressing social stigma has been a key focus of the WHO since the advent of World Mental Health Day in 1992.[43] On that day, individual countries showcase initiatives such as New Zealand's *Like Minds, Like Mine* and Canada's *Opening Minds*.

Suicide is now estimated to account for close to

800,000

deaths per year worldwide.[39,40,44]

The prevalence of MDD increased by

53%

between 1990 and 2013.[20]

Key points	
	The key risk factors for NCDs are either disease-related or healthcare system–related.
	Disease-related factors include tobacco use, air pollution, physical inactivity, etc.—factors that have the potential to be modified to reduce risk of NCD development (modifiable). Other risk factors such as age and sex cannot be modified (non-modifiable).
	Healthcare system–related factors include lack of integration and coordination of clinical care, low patient empowerment, and structural weaknesses in clinical research into multi-morbidity, which, again, can be improved if given adequate focus.

03
Causes of NCDs

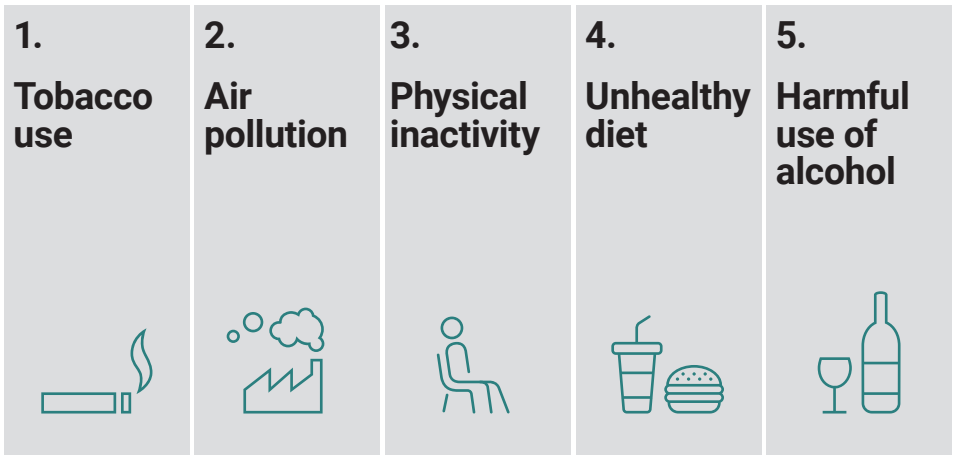
The critical importance of social determinants on the burden of NCD has been well described in various literature. A full review of all social determinants will not be provided in this document, the focus will instead be on disease-related factors, including environmental and behavioral risk factors, and healthcare system–related factors, such as the integration of healthcare and infrastructure.

a

Disease-related factors

The likelihood of acquiring an NCD is affected by environmental or behavioral disease-related risk factors. Some of these risk factors are non-modifiable (age, sex, etc.); however, many of them can be modified (Figure 3).[9]

Figure 3. **The leading environmental and behavioral risk factors for NCDs.***



*Many of these risk factors are directly influenced by increasing levels of urbanization worldwide.

Modifiable risk factors

Tobacco use

Cigarette smoking is responsible for 71% of lung cancer deaths, 42% of chronic respiratory disease, and 10% of CVD mortality.[45] Overall, 1.7 million global deaths were attributed to cigarette smoking in 2015.[46] Rates of smoking are reducing across the world but are unlikely to hit the WHO target of a 30% reduction set for 2025.[47] At the current rate, only a 22% reduction will be achieved.[47]

Air pollution

Air pollution is ranked second among environmental and behavioral risk factors[48] and contributes to the development of devastating NCDs such as chronic heart and lung disease, stroke, and cancers. In 2016, air pollution was responsible for the deaths of 4.2 million people globally and 29% of adult deaths were from lung cancer.[49] Sources of air pollution include transportation, energy production, industry, and household appliances such as inefficient stoves.[50]

Physical inactivity

The definition of physical inactivity is undertaking fewer than 150 minutes of moderate-intensity physical activity per week.[51] One in four of the world's adult population does not meet this definition. A sedentary lifestyle is estimated to result in a 20%–30% increased risk of death compared with an active lifestyle and is linked to an increased risk of stroke, hypertension, and MDD.[51] A direct result of modern conveniences, physical inactivity is much more common in high-income countries (HICs).[52]

Unhealthy diet

Obesity is a recognized health risk for many NCDs, including CVD, diabetes, and cancer.[53] Although obesity was once considered a problem of HICs, it is rising quickly in LMICs. Between 1975 and 2016, the worldwide prevalence of obesity nearly tripled.[54] Alarmingly, obesity is 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.[55] This trend is introducing complications such as diabetes and heart disease to 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. Associated NCDs include liver disease, cancers, CVD, and suicide. In fact, over 200 health conditions have a recognized link.[56] Alcohol consumption is highest in Europe, although rates are falling. The fastest rate of increase is in Southeast Asia (30% since 2010); Africa has the heaviest burden of disease and injury resulting from alcohol abuse.

Urbanization

Urbanization increases the risk of NCDs. This is because modifiable risk factors associated with NCDs are typically more common in urban than in rural areas, such as air pollution, increasing sedentary lifestyles and easier access to unhealthy foods. It follows that the trend toward greater urbanization is likely to increase the burden of NCDs.[57]

Combined risk factors

Risk factors associated with the development of NCDs often combine, and some diseases predispose individuals to developing others. For example, in CVD approximately 75% of morbidity is attributable to modifiable risk factors such as high cholesterol and obesity, tobacco use, physical inactivity, and unhealthy diet.[5]

Non-modifiable risk factors

Certain risk factors for NCDs, such as increasing age and gender, cannot be modified (e.g., CVD is more common in men and MDD in women). Furthermore, some people have a genetic predisposition that increases their risk of developing particular NCDs. It is important to understand these factors to ensure that interventions are targeted at those most likely to benefit.[44] As an example, concepts such as "healthy aging" can help prevent and manage NCDs, namely CVD, in older individuals (see section 5).[58]

b

Healthcare system–related factors

Lack of integration/ coordination of care

Coordination of care is defined as the deliberate integration of patient care activities that occurs among different stakeholders who are directly involved in the facilitation of the appropriate delivery of healthcare services. Coordination of these complex systems is challenging but essential for providing efficient and effective healthcare.[59]

Fragmentation of clinical care

Healthcare systems are often fragmented. In LMICs, health systems are still adapting to the long-term nature of combating chronic diseases versus the acute nature of combating infectious diseases. In HICs, despite being more-developed economies, there are in fact very few truly integrated healthcare systems.[16,60,61] In the United States, patients—particularly those with comorbidities—can see up to 16 different healthcare professionals (HCPs) in a year.[33] This disjointed care is wasteful, expensive, and potentially dangerous as it can lead to overprescribing due to insufficient information sharing.

Primary care is underutilized

Primary care physicians (PCPs) are often the first point of care for patients,[33,62] but in many countries there is limited access to physicians adequately trained to manage multi-morbidity based on the presenting disease. This can limit effectiveness, and alternative models may be needed.[63] Integration can also be lacking between PCPs and secondary and tertiary care, particularly if this integration function is not reimbursed by the healthcare system.[33] This can be compounded if care is provided by many small, independent providers rather than by one coherent system. This lack of coordination extends to PCP and emergency departments, as well as sources of diagnostics, which can lead to duplication of diagnostic tests 22%–43% of the time.[64]
In addition, there is currently a greater focus on physical health than on mental health, so more inter-sectoral care is needed that combines the social, psychological, and physical aspects of healthcare to combat public health crises.

Low patient empowerment

Active participation of patients in their treatment decisions is associated with healthier behavior and increased medication adherence, as well as better care coordination. Communication between patients and HCPs can be poor, limiting shared decision-making between HCPs, the patients, and their families.[33,63] Part of the reason for this is that HCPs are not taught recognized communication techniques during their formal medical training. Furthermore, some older patients may avoid seeking help for both physical and mental conditions due to social stigma and can find navigating a healthcare system challenging. One study showed that 75% of HCPs do not contact their patients to communicate normal diagnostic results post-visit, and 33% do not communicate abnormal results.[64] In another study, 50% of patients left the office visit without understanding what they were told by their physicians. Another study of 1,000 audiotaped visits with 124 physicians showed that patients participated in only 9% of decisions related to their medical conditions, which is a poor indicator of the required engagement for better outcomes. Hence, healthcare is often not patient-centered and innately lacks flexibility to account for patient preferences. To that end, patient empowerment programs should be considering patient needs, the relationship between patients and HCPs, and the functioning of the healthcare system to provide more cohesion.[65]

Research focus is too selective

Clinical trials investigating drug and treatment efficacy are often too selective and can exclude patients with multi-morbidity or frailty. Similarly, clinical trials usually target treatment for single chronic diseases, and more studies are needed to investigate how multi-morbidity is affected by different drug regimens. Despite the high prevalence of multi-morbidity, there is still a great lack of knowledge on how concurrent diseases combine and affect each other.[65]

Limitations in the system and technology

Many healthcare systems are facing financial and organizational challenges. These challenges decrease their ability to integrate care and fully embrace technological advances, resulting in further resource drain and amplification of the problem. Examples include lacking or outdated integrated systems and drug registries.[64]

Finally, analysis of big data is lacking and rarely combines diverse sources (drug registries, healthcare data, etc.). In general, technology in healthcare hasn't been leveraged to enhance clinical trial execution, improve HCP–patient relations, or glean meaningful learnings from diverse data points, thus potentially missing crucial learnings.[64]

Key points	
	NCDs have surpassed infectious and communicable diseases as the leading causes of death globally.
	While the overall prevalence of NCDs is high in both HICs and LMICs, risk profiles and burden differ. • Increasing age and poor adherence are the key drivers for NCDs in HICs. • CVD, population growth, and urbanization are pronounced drivers in LMICs.

04
Global and regional trends

An understanding of current trends and regional nuances will ensure that interventions targeted at NCDs are appropriate for each region or country and that resources are optimally allocated.

a

Global trends

In recent decades, the major causes of death and disease burden have shifted globally from communicable/ infectious diseases to NCDs (Figure 4).[66] Factors that have contributed to this shift include:

- Improved management of infectious diseases, resulting in a global increase in average life expectancy[67]
- A sharp rise in the percentage of the population aged over 60 years[68]
- Slow progression of macro-level policies to address NCDs[69]
- Increasing trends in unhealthy behavior[70]
- Local differences in healthcare provision due to socioeconomic factors and the maturity of the healthcare system[70]
- Large movements of populations from rural to urban areas[57]

Figure 4. **Over the past few decades, the leading cause of disease burden globally has evolved from infectious/communicable diseases to NCDs[66]**

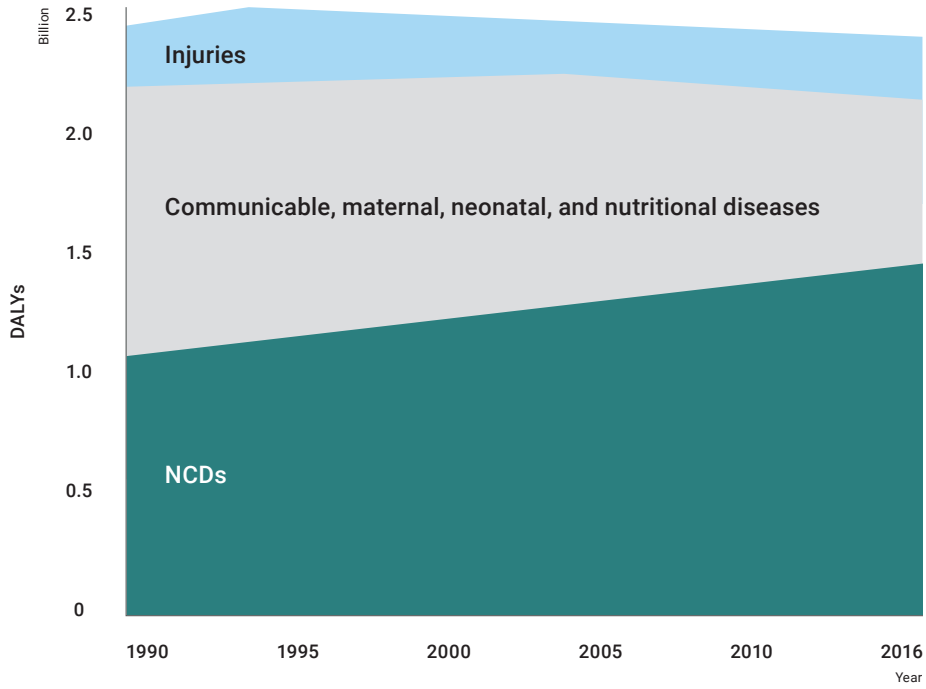
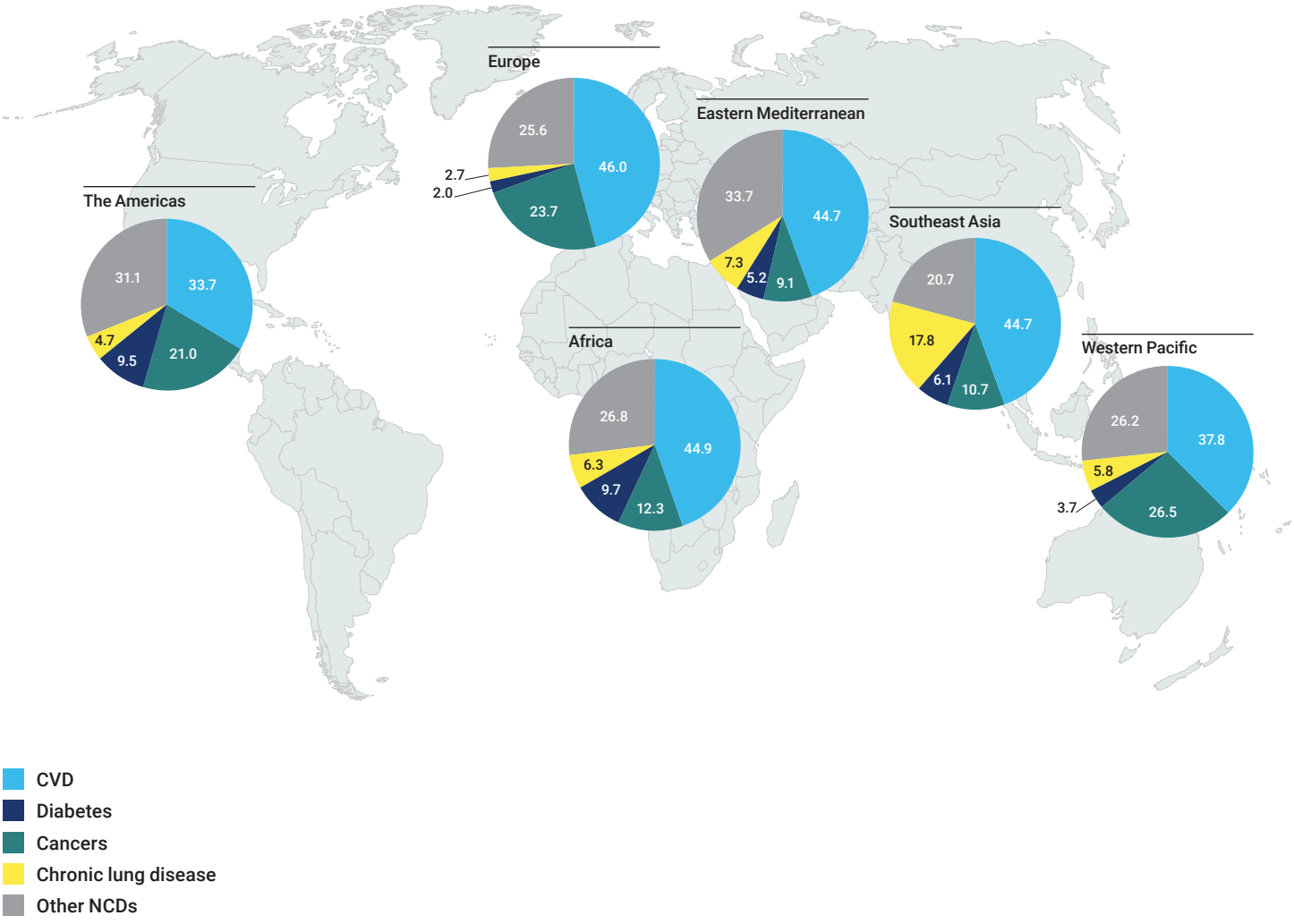


Figure 5. **The global top 4 NCDs resulting in premature mortality, by region***



*Regional figures are percentages of deaths from NCDs in people aged 30–69 years.[71]

b

Mortality trends by region

Across all regions and worldwide, CVD is the greatest driver of mortality among NCDs (Figure 5). Diabetes is the second-highest NCD driver of mortality in the Americas and the third-highest in Africa. Chronic respiratory disease is the third-leading cause of mortality worldwide, as well as in the Eastern Mediterranean region and Southeast Asia. Lung cancer is associated with high rates of mortality in the Americas, Europe, and the Western Pacific region.[71]

Trends in high-income countries

Aging is a key trend driving the prevalence of NCDs in HICs,[72,73] with the population aged over 65 years projected to grow from 9% in 2015 to 17% in 2050 globally.[74] Specifically, the median age in Europe is 42 years, compared with 29 years globally.[75] The number of Americans aged 65 and older is projected to more than double from 46 million in 2015 to over 98 million by 2060.[73] Japan's elderly population will continue to rise from 33% to 42% by 2050.[68] Given that NCDs have a greater impact on the population aged over 65 years than any other age group, the prevalence of NCDs is likely to continue to rise in these countries as their populations grow older.

However, the modifiable nature of many risk factors for NCDs means that the concept of healthy aging is becoming an important consideration in many HICs. 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.[76]

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.[77] Adherence among patients with chronic diseases averages only 40%–50%. Using MDD in Spain as an example, adherence to medication is only 28%.[78-80]

Trends in low- and middle-income countries

NCDs are poised to become the dominant cause of death in LMICs. LMICs are often growing economies with a trend toward greater urbanization. As people attain a better standard of living with more disposable income available to spend on tobacco, alcohol, transport, and higher-calorie foods, the risk factors for NCDs can be expected to rise.[57,81] Two geographical areas that are seeing this impact are South Asia and Africa. In South Asia, the 2008 mortality level of 51% is projected to rise to 72% by 2030. In sub-Saharan Africa, mortality is still heavily influenced by infectious diseases, but the proportion of deaths due to NCDs is projected to grow from 28% in 2008 to 46% by 2030.[82]

Trends in China

China is a rapidly growing economy with a substantial and growing NCD burden. Given the size of its population, the future of NCDs in China is a major determinant of what will happen globally. NCDs are estimated to be responsible for 89% of all deaths in China[8] and, without effective intervention, the expectation is that the percentage will continue to rise considerably over the next decade. The main contributing factors are population growth and aging (Figure 6).[83] China's population is projected to continue to grow between 2010 and 2030 by 40 million (2.9%).[84] This is compounded by a growth rate rarely seen in other countries—the over-65 population will double to 20% of the total population in 20 years.[85]

Figure 6. **Increasing aging demographic of the population in China over the 21st century**

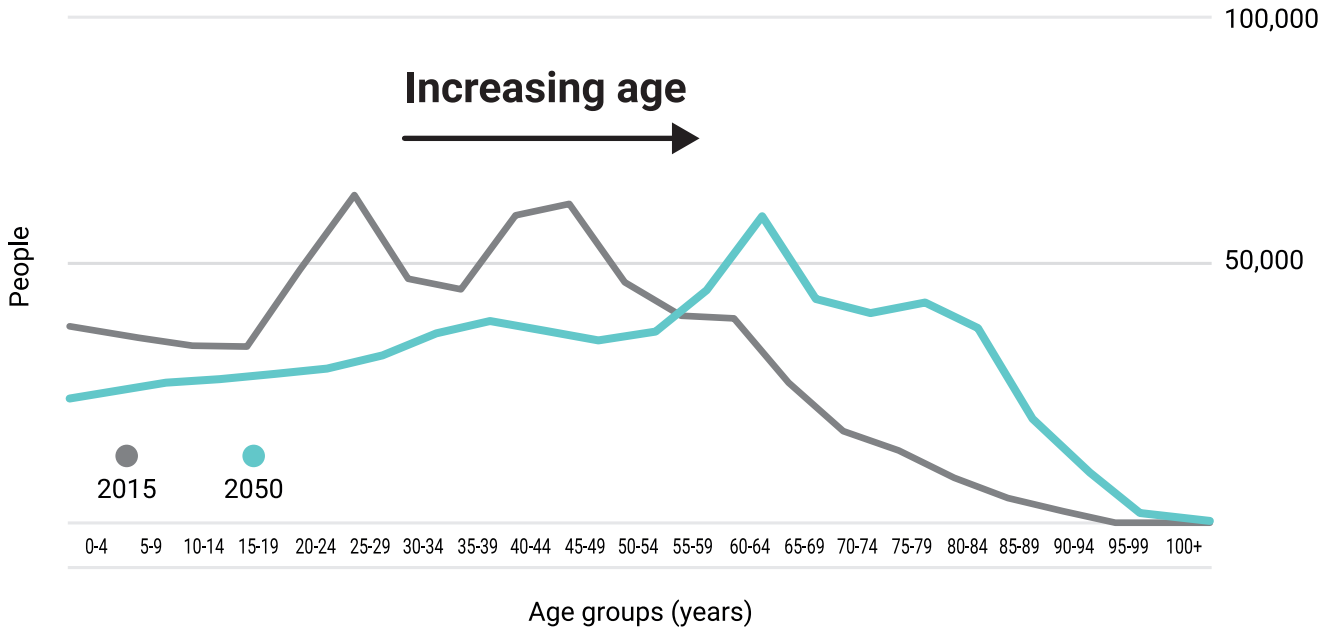
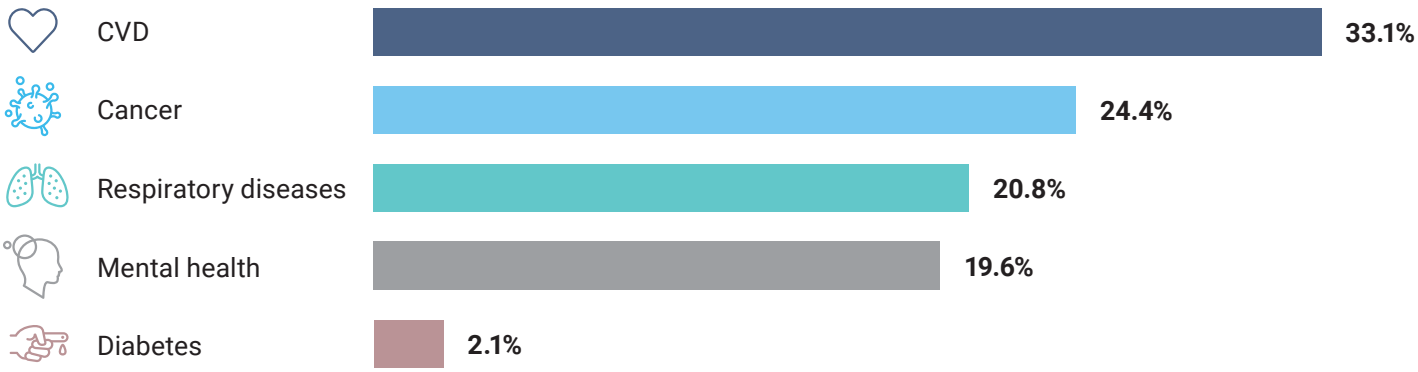


Figure shows female population for clarity. The male population demonstrates a similar increase in age.[85]

Figure 7. **CVD is the leading cause of lost productivity/economic output in China**



Adapted from Bloom DE, et al.[86]

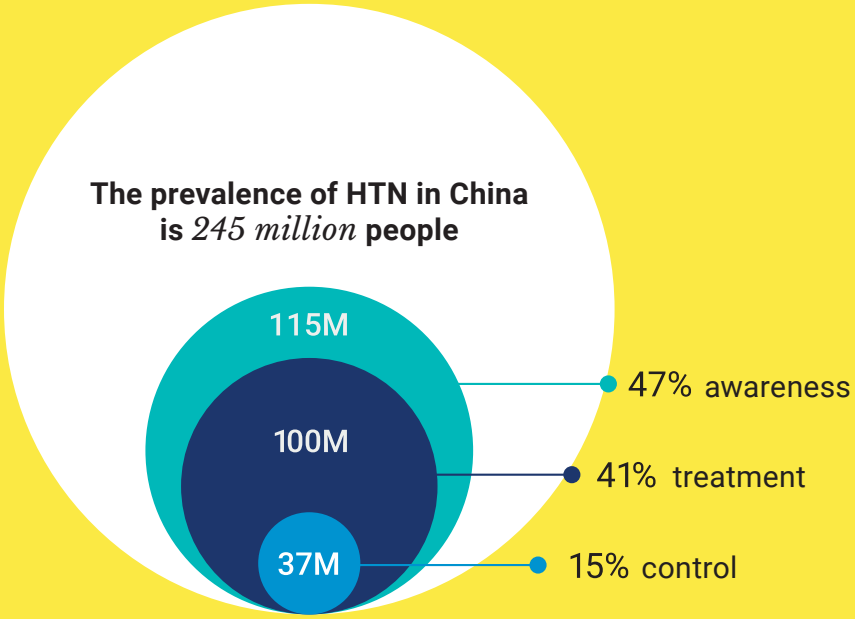
An increase in unhealthy behavior is further inflating the prevalence of NCDs. Cardiovascular and chronic respiratory disease make up almost three-quarters of China's NCD burden and its associated cost burden (Figure 7).[86] Contributing to this is the level of smoking in the country: 48% of men smoke, compared with only 2% of women.[87] Given the prevalence of smoking at home and in public, 72% of nonsmokers are regularly exposed to secondhand smoke. A total of 1.4 million people in China die from smoking-related disease annually.[88]

SPOTLIGHT
on hypertension in China

The prevalence of hypertension in China continues to rise, with current estimates reaching 245 million citizens. Alarmingly, more than half of those with hypertension are not aware they have it, and only 15% receive adequate treatment (Figure 8). Multifactorial interventions to improve awareness, treatment, and goal attainment are urgently required.[89]

Hyperlipidemia has seen similar trends in recent years with low rates of awareness and control. In response, the Cardiovascular Physician Branch of the Chinese Medical Doctor Association and the Chinese Preventive Medicine Association with support from Pfizer China launched the "Bending the Curve" initiative.[90] A comprehensive lipid screening, diagnosis, and education program, Bending the Curve is on track to provide screening for 225 million people by the end of 2020.

Figure 8. **People with hypertension in China**



Key points	
	Management of NCDs should target the causes, prevention, and progression of disease.
	Effective strategies should optimally tackle disease- and healthcare system–related factors simultaneously.
	The WHO “best buys” provide a cost-effective approach to responding to NCDs.

05

Interventions to combat NCDs

An integrated approach that targets both disease-related and healthcare system–related factors is recommended, with the aim of providing effective healthcare for patients throughout their lifespans.

To respond to the NCD challenge, an integrated approach should be utilized, as recommended by the WHO NCD Action Plan, the UN SDG target 3.4,[91] and the Centers for Disease Control and Prevention (CDC) Chronic Disease Prevention and Health Promotion domains.[92] This approach targets disease-related factors (e.g., prevention of disease) and healthcare system–related factors (e.g., evidence-based treatment of NCDs, integration of services, resource access, and utilization) to improve care over the long term.

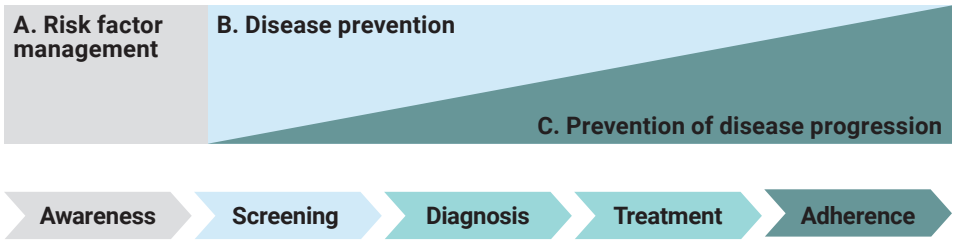
a

Disease-related factors

It is helpful to break down the management of disease-related factors for NCDs into three stages:

1. Targeting risk factors
2. Preventing disease development
3. Stopping disease progression or recurrence

Figure 9. **Stages in the management of NCDs**



Source: Upjohn Research, Development and Medical, 2019

It is important that healthcare professionals/providers (HCPs) have tools and knowledge available to intervene along all stages of NCD management (Figure 9). Early on, this includes opportunities to help manage and educate on the risk of NCDs. Later, HCPs need to screen, diagnose, and treat presenting NCDs in an evidence-based fashion and help keep patients adherent with their treatment.

Interventions focusing on environmental, economic, and social policies can lead to structural changes that create a healthier environment for the whole population. Examples of key factors include access to clean air and water, education, and a functioning local economy.[48,93,94] This may require legislation and changes in government policies. A good example is the WHO "best buys" for NCDs, 16 recommended interventions covering six policy areas that are both cost-effective and feasible for implementation (Table 1).[8]

Table 1. WHO "best buys" for NCDs[8]

Tobacco control	01. Increase taxes on tobacco 02. Add large health warnings on all tobacco packages 03. Ban tobacco advertising 04. Eliminate exposure to secondhand tobacco smoke 05. Educate with mass media campaign about the harms of smoking/tobacco use
Alcohol use	06. Increase taxes on alcohol 07. Ban or restrict alcohol advertising 08. Restrict physical availability of retailed alcohol
Food use	09. Reduce salt intake through reformulation of food products 10. Reduce salt intake through the establishment of a supportive environment in public institutions 11. Reduce salt intake through a behavior-change communication and mass media campaign 12. Reduce salt intake through front-of-pack labeling
Physical activity	13. Implement public education and awareness campaign for physical activity
Managing CVD & diabetes	14. Drug therapy (including control for diabetes and hypertension) and counseling to individuals who have had, or are at a high risk for, heart attack/stroke/CVD
Managing cancer	15. Vaccination against human papillomavirus (2 doses) of 9–13-year-old girls 16. Prevention of cervical cancer by screening women aged 30–49 years

Education is vital in raising awareness so individuals can be encouraged to avoid the unhealthy behavior associated with developing NCDs.[95-97] Increased health literacy encourages the early detection of NCDs and their risk factors, and it improves self-care.

SPOTLIGHT
on ethics

There is a political aspect to the ethical questions surrounding NCDs, with no easy answers. Often this comes down to funding. Countries (regardless of overall income) may have to allocate limited funding, leading to difficult choices for governments, NGOs, private sector, and other stakeholders.

Dilemmas countries may face include:[93]

- Should there be less personal privacy in order to better monitor disease epidemiology?[98]
- Should efforts target people with the most need or target improvements that would benefit the most people?
- Should more be taken from infectious disease programs to fund NCD programs?
- Should higher-income countries donate more aid to LMICs to tackle NCDs? Despite unequal resources, post the financial crisis this is unlikely to happen when even rich countries have large numbers of people in need and an increasingly aging population.
- Should resources be aimed at treating people who already have diseases or directed toward prevention programs?
- Should resources be targeted at younger versus older populations?

b

Healthcare system–related factors

The integration of a healthcare system to allow the holistic management of patients throughout their lifespans is a key factor in improving the management of NCDs.[99] Achieving this requires effective collaboration across all areas of the healthcare system, including primary, secondary, and tertiary care, to provide inter-sectoral care.[100,101] PCPs, secondary/hospital care specialists, pharmacists, physiotherapists, residential care specialists, and mental health specialists need to work together to coordinate care by optimizing the referral system and using the relevant evidence-based treatment pathways for each NCD.[101] PCPs are often the first point of care for patients,[33] so improving NCD management is a priority for them.[63] They can regularly monitor the health of the patient, ensure adherence to medication, and provide the necessary education.

Education for HCPs on the international standards of NCD treatment, including guideline-based protocols of care (e.g., the US "Get with the Guidelines" initiative), can help improve patient care.[102] These initiatives help standardize care through a unified, therapeutic approach and thus reduce variability in care across regions.

An infrastructure that can support and improve the delivery of healthcare is vital. This may require building increased capacity to improve the distribution of healthcare services and investing in information technology connectivity and electronic medical information access to evaluate efficiencies and share patient information.[103,104] Meaningful and measurable data on patient outcomes is required, both before and after any intervention, to improve the quality of care. Comparisons against benchmarks or historical controls can also be informative. Data from programs aimed at improving the adequacy of patient care can be used to bridge knowledge gaps and elucidate treatment pathways. Patient feedback (e.g., from patient advocacy groups or HCP/patient interactions) should be collected and used to improve care.

In many parts of the world, access to and affordability of critical medicines are poor. Even in HICs, access to modern healthcare can be limited due to various factors such as increasing wait time at doctors' offices, non-optimal quality of services,[73] or formulary restrictions on access to medications.[105] Resource utilization can be improved by providing high-value services and using the most cost-effective interventions in each setting to ensure sustainability. Access to medications can be improved by influencing policies and formulary placement. The use of optimal national or insurance-based coverage can lower cost of care. Overall, an increased commitment from multiple stakeholders is needed to fully integrate healthcare systems at a national and international level.

c

Economic benefits of intervention

It is estimated that every US dollar invested in these strategies will yield a return of at least US$7 by 2030. Full implementation of identified strategies could save 8.2 million lives in poorer countries and generate US$350 billion in economic growth by 2030.[106]

By 2030:

Every US dollar
invested to tackle
NCDs is estimated to
yield a return of
at least US$7

NCD interventions can
save 8.2 million lives
in poorer countries

and generate
US$350 billion
in economic growth

SPOTLIGHT
on the United Arab Emirates

The United Arab Emirates (UAE) is one country recognized for being on track to meet the WHO's target to reduce NCD-related deaths by 30% by 2030.

But the UAE is challenging itself to deliver against these targets even sooner—nine years sooner to be exact.

Reducing the prevalence of NCDs in the UAE is at the heart of a multifaceted approach to improving the country's overall health and economic standing. That is why the UAE Vision 2021 National Agenda, which coincides with the 50th anniversary of the country, calls for implementation of health-centric initiatives that support early detection, discourage unhealthy choices, and educate the public on healthy lifestyles.[107]

Demonstrating commitment to remaining focused and on track, the government has established NCD-related performance indicators in the areas of CVD, cancer, smoking, diabetes, and childhood obesity. Further proving its commitment to celebrating the country's 50th birthday in health, a minister has been assigned to oversee the progress of each indicator.

Key points	
	A dynamic interplay between stakeholders can help optimize the delivery of interventions targeted at NCDs.
	Civil society organizations, governments, multilateral organizations, the private sector, HCPs, and academia have a shared interest in reducing the global burden of NCDs.

06

Stakeholders for managing NCDs: Making a positive difference

To effectively catalyze action around a crisis as complex and wide-sweeping as NCDs, an inter-sectoral approach is required, involving diverse stakeholders.[108]

There is a dynamic interplay between the major stakeholders in the management of NCDs: civil society organizations (CSOs), governments, multilateral organizations (MLOs), the private sector, HCPs, and academia (Figure 10). Connecting all these stakeholders are patients. This interplay can promote ambitious national inter-sectoral responses for the prevention and control of NCDs while forging partnerships/alliances and sharing knowledge. These stakeholders also assess progress, provide services, amplify the voices of, and raise awareness about people living with NCDs.

a

Civil society organizations

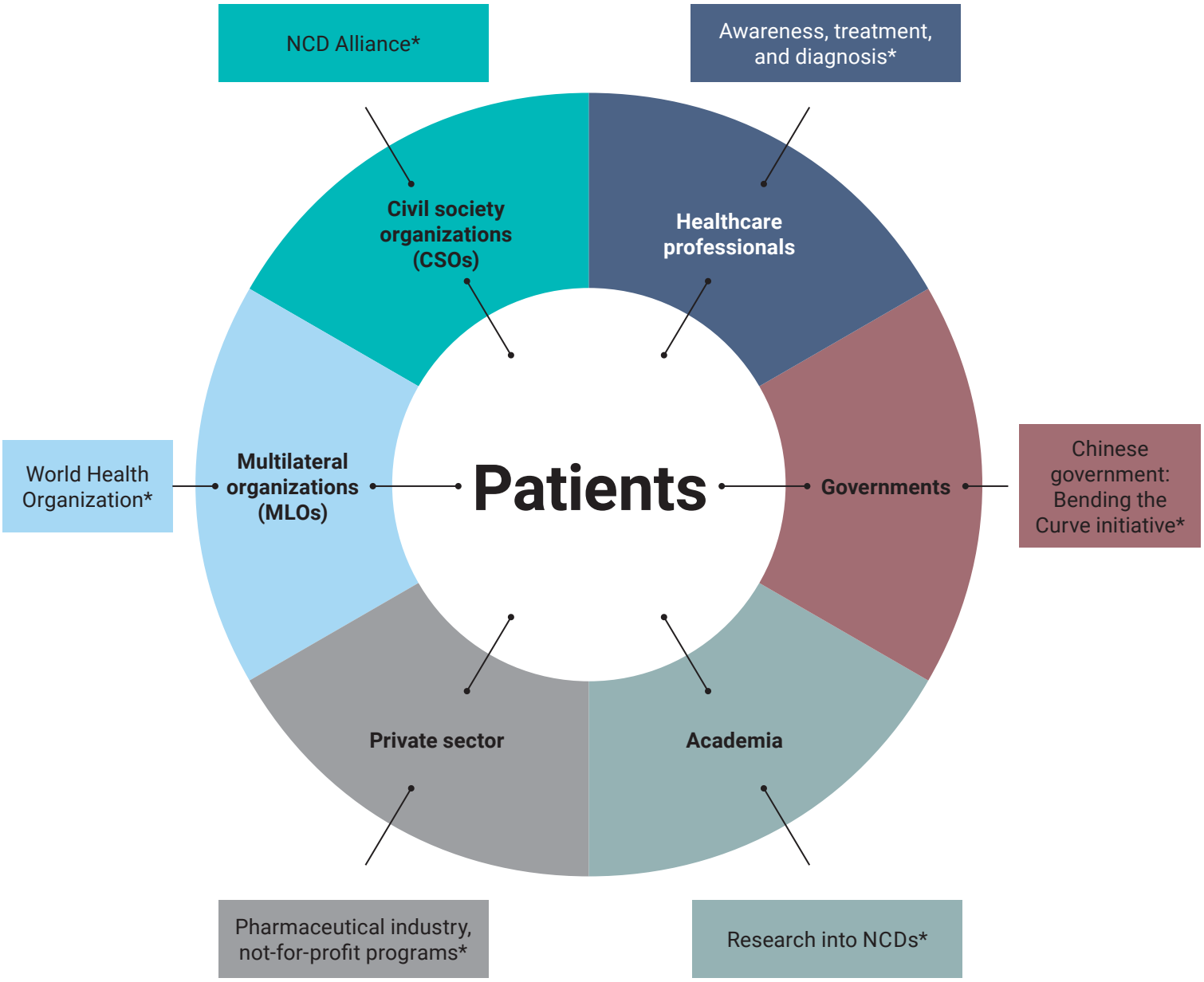
CSOs are nongovernmental, not-for-profit organizations including patient advocacy organizations that advocate for the interests of their members[109] by influencing policy makers and businesses.[110] Examples of CSOs include the United States Pharmacopeial Convention, which sets standards for pharmaceutical ingredients and seeks to detect counterfeit medicines,[111] and the NCD Alliance, which focuses on prevention and control of NCDs. The NCD Alliance unites 2,000 CSOs in more than 170 countries to provide a focal point for efforts to improve NCD care and prevention.[112]

b

Governments

National governments have committed to combating NCDs through policy, research, and membership in MLOs.[113] Notable examples include the UK Prevention Research Partnership (UKPRP), which invested £25 million (US$32 million) in understanding and influencing factors that affect NCDs,[114] the Brazilian Strategic Action Plan to Tackle Noncommunicable Diseases,[115] and the Bending the Curve initiative in China (see Spotlight on China).[90]

Figure 10. **Patients are at the center of stakeholder efforts to reduce the NCD burden**



Source: Upjohn Research, Development and Medical, 2019.
*Example stakeholder.

c

Multilateral organizations

Examples of MLOs include the WHO, the World Bank, and the UN.[116,117] The WHO set up the Global Coordination Mechanism on the Prevention and Control of NCDs, a coordinating and engagement platform, in 2014.[118] The three strategic priorities of this organization are to:

1. Foster multi-stakeholder collaboration
2. Promote a better understanding of the challenges identified
3. Pilot capacity-building approaches to develop expertise

d

Private sector

The private sector comprises for-profit businesses that have an interest in the prevention and control of NCDs. The pharmaceutical sector is a large contributor, as are companies in the food and beverage sector.

In December 2018, Pfizer reorganized its business, creating Upjohn—a business unit dedicated to reducing the burden of NCDs globally through its portfolio of 20 iconic brands, including Lipitor, Norvasc, and Viagra. This is one example of the private sector mobilizing around the evolution of healthcare needs.

e

Healthcare professionals

HCPs are the central pillar for treating, screening, and providing education for patients. Most efforts to improve a healthcare system will go through, or have an effect on, the HCPs delivering treatment. Effective communication between physicians and their patients, and all other HCPs engaged in the patients' treatment plans, including pharmacists and nurses, is key to providing integrated care for patients. Throughout the document this crucial role is highlighted, especially that of PCPs in the coordination of overall care (see sections 3 and 5).[61]

> *The NCD Alliance unites 2,000 CSOs in more than 170 countries to provide a focal point for efforts to improve NCD care and prevention.*[112]

f

Academia

The primary role of academia is its research into NCDs, principally in conducting surveillance and data analysis. Often individual researchers are more visible in NCD research than the institutions themselves. In the future, combining individual pieces of NCD research into a cohesive whole will be beneficial, as it will give better visibility to academic research sponsored by governments and multinational bodies. (For example, academia could liaise with other stakeholders to define the true impact of multi-morbidity using big data sets.)

Academia can also take a more strategic advocacy role. Academic endeavors can incorporate training on healthy activities and lifestyles into community-based programs. Academia can also partner with other stakeholders to provide evidence for policy.[61]

g

The way forward

It is essential that all stakeholders with an interest in combating NCDs renew their efforts and unite to improve the care of patients with these diseases. Lessons can be learned from previous successful worldwide movements in healthcare, such as the implementation of antiretroviral therapy for HIV across both HICs and LMICs,[119,120] or vaccination programs against smallpox and polio.[121] The challenge of NCDs may be even greater, as their driving factors go beyond healthcare and will require inter-sectoral programs to prevent further increases. However, lessons from the HIV movement can show us the way. Public pressure made HIV a global priority. This can also happen for NCDs as awareness increases. Upjohn is an ideal vehicle for action, given these learnings, and there is an opportunity for all major stakeholders to take action to address the challenge.

SPOTLIGHT

on CVD education in Latin America

Cardiovascular patients in Latin America who seek timely and accurate information often find themselves turning to the internet.

In a recent month, more than

21,500

viewers across Latin America visited WikiCardio.

As with any web search, results can redirect the person to a multitude of sources; and while some sites may be highly credible, others may provide inaccurate, misleading, or outdated information that has not been endorsed by a well-known scientific society. Access to such incomplete and/or inaccurate information can negatively impact the diagnosis, treatment, and adherence for these patients.

In response to this dilemma and with support from Pfizer, the Argentina Society of Cardiology (ASC) launched WikiCardio – a free, reliable, web-based resource that empowers viewers with answers to common questions related to CVD awareness, prevention, diagnosis, and treatment (wikicardio.org.ar). Nearly 200 local cardiologists, scientific journalists, and website designers contributed to the site's initial development, and since its October 2015 launch in Argentina, WikiCardio has expanded to include 14 countries throughout Latin America, partnering with relevant local cardiology societies in the process. In a recent month, more than 21,500 viewers across Latin America visited WikiCardio, validating the demand for trusted, reliable information as an important factor in any community's strategy to relieve the burden of NCDs.

Key points	
	Significant variability among nations exists in both their NCD burden and their preparedness to tackle NCDs.
	NCDs are a significant burden across all countries, regardless of socioeconomic status (LMICs, HICs).
	Upjohn built the SNAP framework to provide strategic solutions to tackle NCDs based on archetypes defined by countries' needs and priorities.
	The causes of disease burden vary, and the strategies to decrease them are not one-size-fits-all.

07

Steps toward actionable solutions: Upjohn SNAP framework

Considerable variability exists in the burden of NCDs across nations and in corresponding intervention strategies.[19,122] Therefore, it is important for countries to develop strategic frameworks for utilizing this information. Entities can then use these frameworks to determine which country would benefit most from a particular intervention.

a

Upjohn strategic segmentation for NCD country action plans (SNAP)

Upjohn developed SNAP as a strategic framework for determining intervention strategies that are market-specific, accounting for local NCD dynamics. It segments countries based on multiple variables to inform its strategies: in LMICs, NCD burden and policy preparedness; in HICs, GNI and DALYs.*

This framework is the first of its kind and uses evidence from credible external sources, including the Global Burden of Disease (GBD) study,[123] WHO country profiles,[8] and World Bank statistics,[10] as well as validation by local data.[8] This allows prioritized implementation of initiatives to lower the toll of NCDs.

SNAP uses evidence from these sources:

- The GBD study, which permits a robust comparison of 195 nations and quantifies the NCD burden in each country[123]
- WHO's published country profiles, which report on country capacity to address and respond to NCDs across 15 parameters and include progress against national targets based on the Global Monitoring Framework[8]
- World Bank statistics, which provide guidance on GNI information by country[10]
- Local data, which shows the unique NCD landscape by country[8]

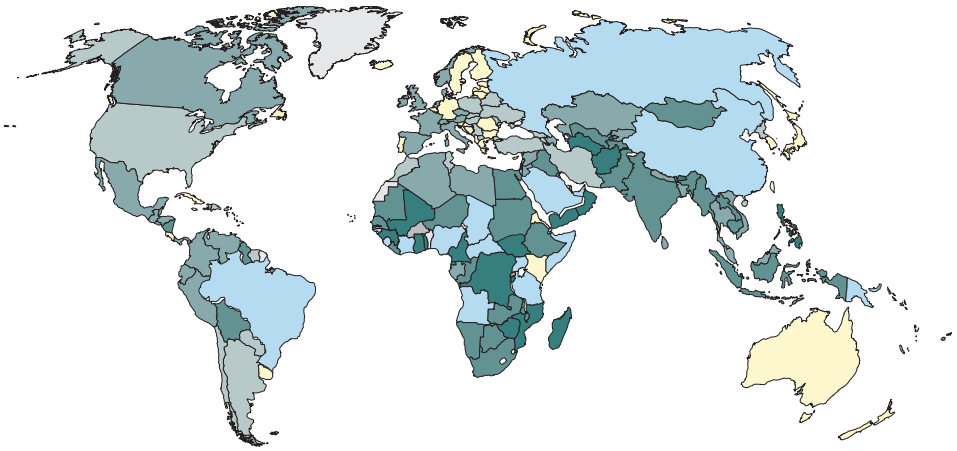
*Upjohn generally refers to LMICs as emerging markets and HICs as developed markets. Please see detailed listing of the countries according to how regions are organized in Upjohn on page 9.

LMIC strategies

Upjohn has used information on NCD burden of disease and policy preparedness to segment LMIC countries into four distinct NCD archetypes:

- Advocacy
- Focus
- Leverage
- Observe

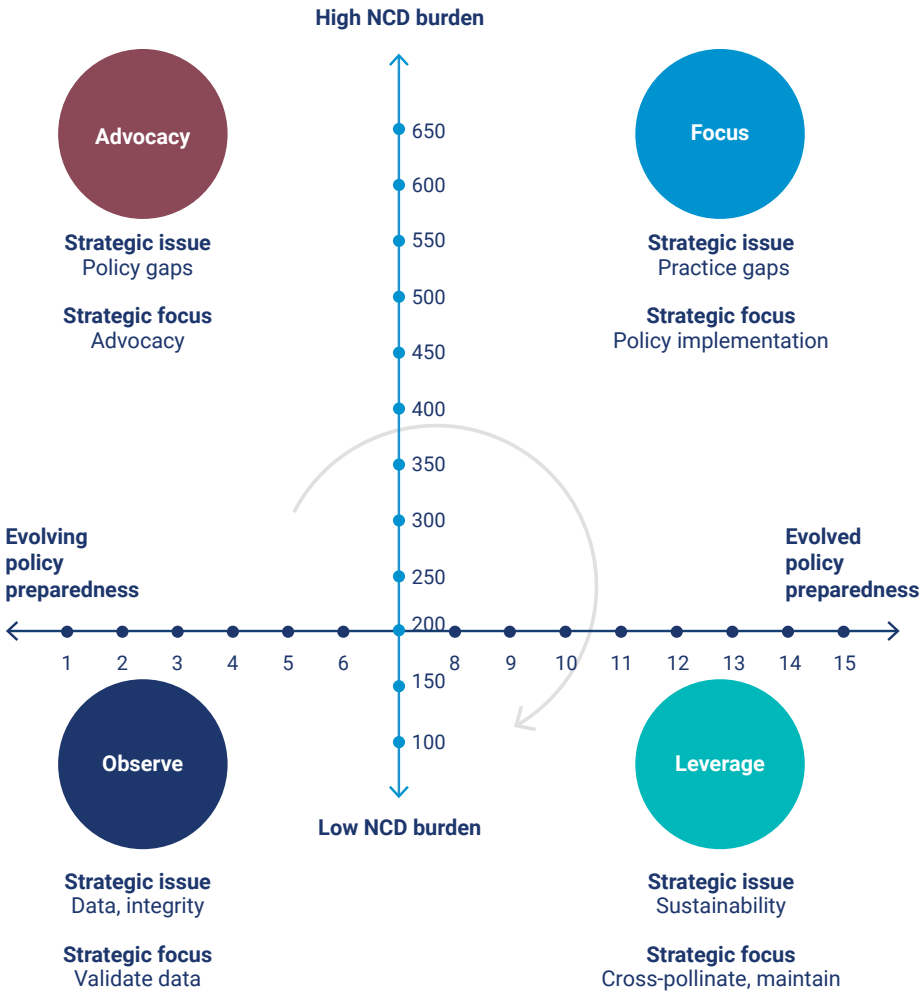
Each archetype describes a different set of priorities that should be applied when planning initiatives in that country group (Figure 11).



The GBD study permits a robust comparison of 195 nations and quantifies the NCD burden in each country

Figure 11. **The quadrants of the SNAP framework in LMICs**

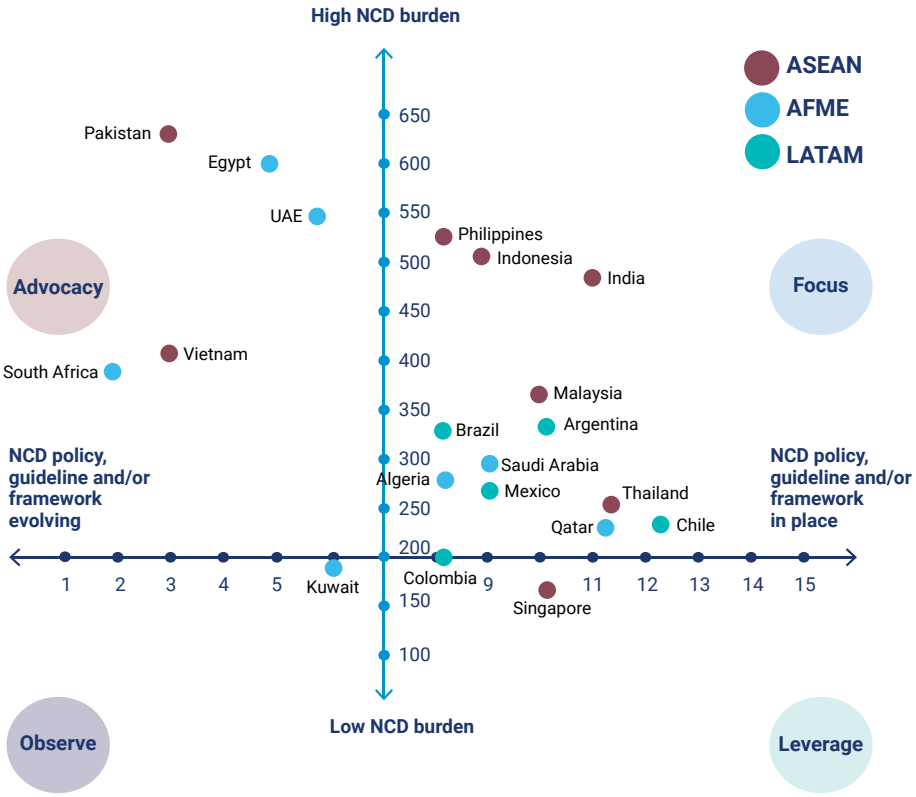
Advocacy, Focus, Leverage, and Observe



X axis: Each country's readiness to combat NCDs as score from 0 to 15

Y axis: NCD burden as identified by age-standardized death rate among populations aged 30–70 years (scale: 0 to 700 deaths per 100,000)

Figure 12. **Countries segmented into four archetypes using the SNAP framework**



X axis: Each country's readiness to combat NCDs as score from 0 to 15

Y axis: NCD burden as identified by age-standardized death rate among populations aged 30–70 years (scale: 0 to 700 deaths per 100,000)

Using SNAP, Figure 12 provides a snapshot of the top 20 priority LMICs with respect to key strategic issues related to NCDs.

Source: Global Burden of Disease, NMH Profiles, 2017.

Shaping policy in "Advocacy" countries

The SNAP framework shows that no country has yet completed all the requirements to be in full readiness to combat NCDs. For example, in Egypt the policy (or national framework) is still evolving while NCD burden remains high. This insight can guide efforts on collaborative initiatives to shape policy or support the development of clinical practice, such as guidelines for NCD care, with the aim of increasing the country's preparedness (Figure 13, quadrant 1).

Thus, in "Advocacy" countries, stakeholders have the opportunity to collaboratively develop inter-sectoral frameworks that can target one or several NCDs and aim to reduce risk factors in countries where there is a policy deficit.[124]

Improving clinical practice in "Focus" countries

Significant gaps remain in knowledge and clinical practice in the management of NCDs. This issue is clear in the second group of countries, those with a high NCD burden despite an evolved policy framework. SNAP guides Upjohn to target nations where policies and frameworks exist but practice gaps remain.

Malaysia is an example of a "Focus" country—only around 37% of patients treated for hypertension have controlled their blood pressure.[125] This contrasts with a country like Canada, where control is achieved in more than 80% of patients.[125] Armed with this insight, Upjohn's NCD Country Action Plan for Malaysia can focus on training PCPs to manage hypertension and on increasing awareness of guideline recommendations. These initiatives can measure both process and impact (Figure 13, quadrant 2).

Harnessing excellence in "Leverage" countries

The SNAP framework has identified certain countries (e.g., Singapore) that have excellent NCD policies and frameworks in place and, not surprisingly, a lower NCD burden. This allows the focus in these countries to be on supporting sustainability of their environment and maintaining their capability to decrease their NCD burdens (Figure 13, quadrant 3).

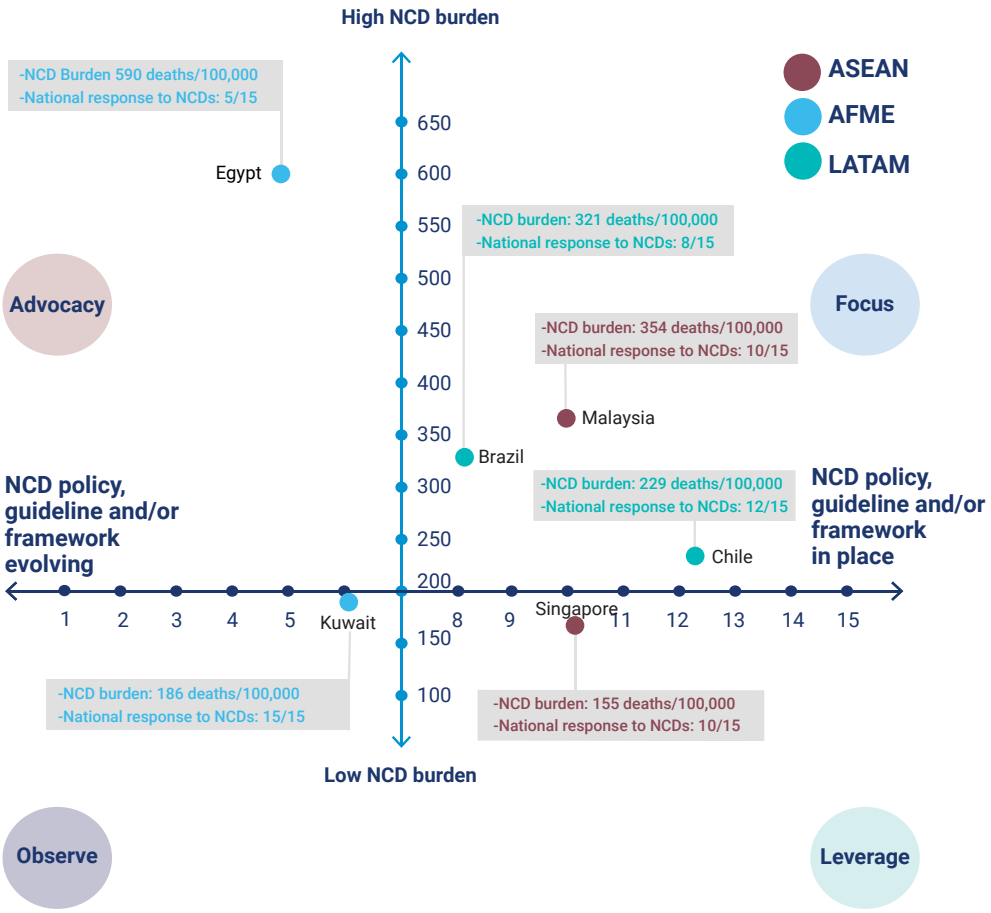
The insight also permits stakeholders to consider exporting best practices from these countries to others by leveraging the excellence in NCD care shown by a "Leverage" country. Best practices could include processes within government, the public health system, or the private sector that demonstrate improved outcomes for patients.

Maintaining a watch on "Observe" countries

In the SNAP framework, no country should demonstrate low NCD burden where policy preparedness is poorly developed or early in its evolution. If a nation falls in this quadrant, it is likely that its data is inadequate or has been compromised or corrupted in some manner. SNAP guides stakeholders to maintain a watching brief on these "Observe" countries, seek further information, and continue to evaluate the data as it is updated (Figure 13, quadrant 4).

"Malaysia is an example of a "Focus" country—only around 37% of patients treated for hypertension have controlled their blood pressure.[125]"

Figure 13. **SNAP framework with examples of countries in each quadrant**



X axis: Each country's readiness to combat NCDs as score from 0 to 15

Y axis: NCD burden as identified by age-standardized death rate among populations aged 30–70 years (scale: 0 to 700 deaths per 100,000)

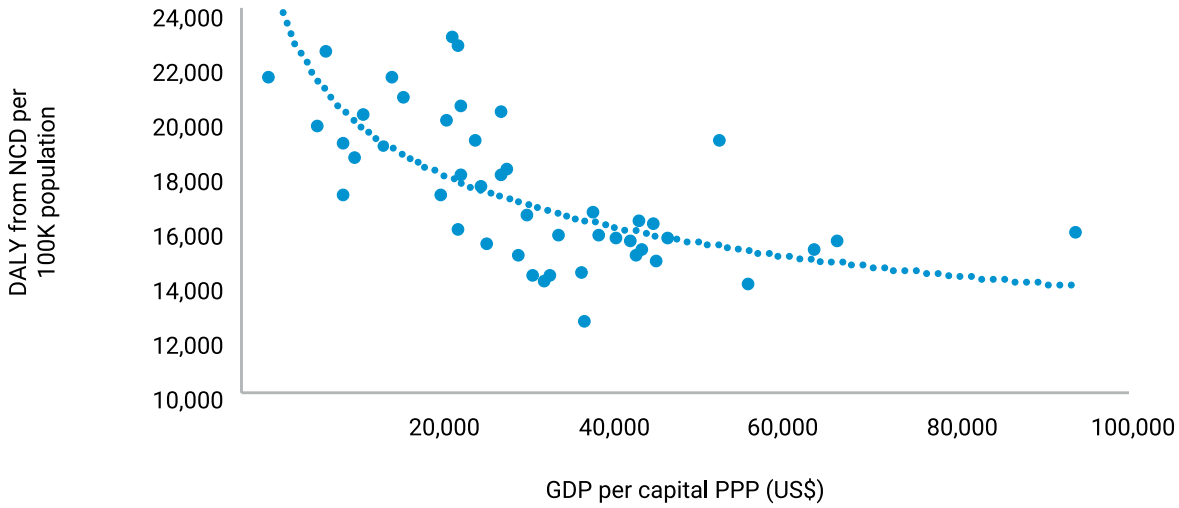
Source: Global Burden of Disease, NMH Profiles, 2017.

SNAP framework for HICs

The SNAP framework, using policy preparedness and NCD burden* as variables, would suggest that HICs, due to their relatively established policies, would fall into the "Leverage" quadrant (Figure 13, quadrant 3).

A select few countries with an Upjohn footprint in the developed market region (HIC category) were plotted. As expected, DALYs per 100,000 people tend to be lower for developed markets with higher GDP per capita (Figure 14).

Figure 14. **Association between HICs and NCD burden**



PPP: purchasing power parity

Data source: https://ourworldindata.org/burden-of-disease[66]

GNI countries have been categorized based on GNI per capita: this is the dollar value of a country's income in a year, divided by its population. It reflects the average income of a country's citizens for the 2019 fiscal year, calculated using the World Bank Atlas method.

*In SNAP, the NCD burden for LMICs was quoted in absolute numbers (e.g., 200 deaths/100,000 population). For HICs, the percentage of all deaths that are attributable to noncommunicable disease was used as the NCD burden.

NCD burden in HICs

When looking into the WHO country profiles for HICs, 80% of deaths are attributable to NCDs, despite the majority of those countries being in the high GNI category.[8] For instance, the NCD burden on average for Italy, the UK, and Australia is around 90% for each country.

Hence, HICs would benefit from a solution-oriented strategy that accounts for the local NCD landscape and the diverse needs across markets, which can differ from those of LMICs.

HIC strategies

Based on Upjohn's local market experience, NCD data gaps were identified and validated by local data. Three distinct strategies for HICs emerged:

- Disease-specific
- Achieve healthy aging
- Adherence to medication

Certain countries could partake in multiple strategies (e.g., disease-specific plus adherence, or disease-specific plus healthy aging).

Disease-specific

Depending on the most prevalent disease and/or the highest contributor to the NCD burden in a particular country, disease-specific strategies and tactics were identified and set forward. Tactics that can be deployed include preventive measures, increasing awareness of diseases, improving health literacy, and educating HCPs on evidence-based treatment to improve patient outcomes. These measures are mainly effective in (but not limited to) countries with GNI lower than US$12,500. However, disease-specific strategies can be the most effective in some markets above GNI US$12,500 if a specific disease-related public health issue has been highlighted as a local priority.

Achieve healthy aging

NCD prevalence increases with age,[23] and the worldwide population aged 65 years and over is expected to grow substantially in the future.[73,74] The increase in the proportion of older adults,[126] combined with their burden of chronic conditions and age-associated syndromes,[126] has created an urgent challenge for public health and medical practice for the aging population.[126] Markets that implement healthy aging strategies prioritize some specific areas: improving treatment-adherence interventions; developing and increasing the use of integrated care models; increasing awareness of effective management of NCDs at the patient, family, and caregiver level; and increasing patient engagement and empowerment. Healthy aging is a key objective for decreasing the burden of NCDs in HICs given the unique demographics in these countries.

> *Increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments.*

Adherence to medication

Lack of adherence to medication for highly prevalent diseases has a negative consequence on patient outcomes and places an overall drain on healthcare resources.[127,128] Haynes et al. highlights that "increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments."[129]

Annual costs of medication non-adherence range from US$100 billion to US$290 billion in the US, to €1.25 billion in Europe, to approximately AU$7 billion in Australia.[128]

Overall analysis

Figure 15 shows examples of countries segmented by the local NCD landscape to ensure a fit-for-purpose strategy. Three examples are:

- Spain – adherence to medication
- Japan – achieve healthy aging and disease-specific strategy (mental illness)
- Russia – disease-specific strategy (CVD)

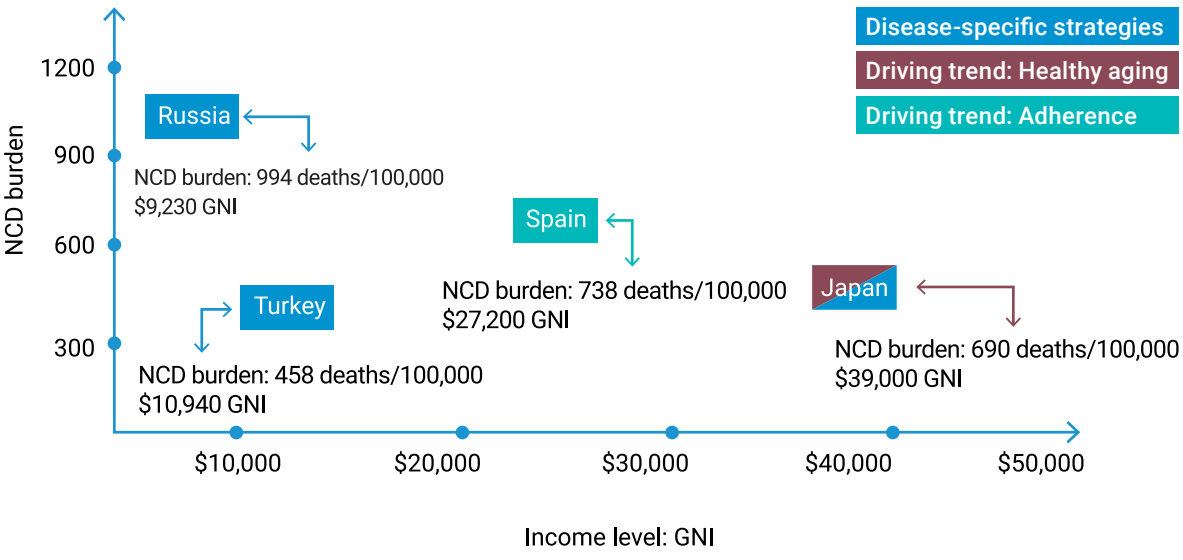
Annual costs of medication non-adherence range from

US$100~$290
billion
in the US

€1.25
billion
in Europe

AU$7
billion
in Australia

Figure 15. **Country segmentation by NCD landscape**



Data source: World Bank GNI index; WHO NCD country profiles.

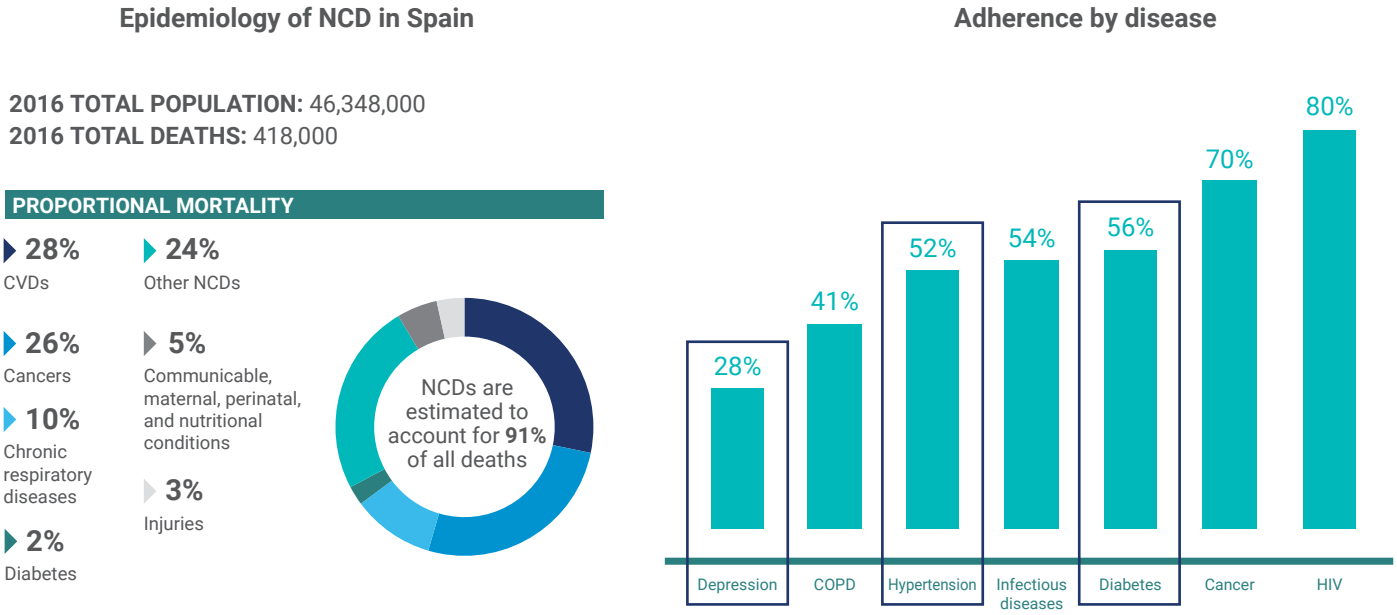
Spain: Adherence to medication strategy

Spain is considered a moderately high-income country. Its main strategy is generating positive health outcomes through increasing adherence to therapy in different diseases, such as CVD and mental illness.

Diving deeper into Spain's local NCD analysis, a large proportion of CVD- and cancer-related mortality was found (Figure 16). Furthermore, adherence in chronic disease was variable, at 70%–80% in cancer and HIV, 52% in hypertension and diabetes, and an alarming 28% in depression (Figure 16). Non-adherence resulted in negative health and economic outcomes.[80]

Strategies geared toward improving adherence to CVD treatment in Spain would lead to a significant reduction in the burden of NCDs. Specifically, the Spanish Health System data found that a 1 point increase on average in adherence would lead to a reduction of ~€11 million in direct health expenditure, saving more than 1,200 lives and 1,100 cardiovascular events.[80]

Figure 16. **Lack of adherence to medication in CVD contributes to high burden of NCDs**



Japan: Achieve healthy aging and disease-specific strategy (mental illness)

Japan has the lowest NCD burden with the highest income per capita relative to other countries. 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.[130] People aged 65 and older make up one-quarter of its total population; the estimate increases to one-third by 2040, outpacing several other major countries (Figure 17).[131]

Figure 17. **Japan has the highest proportion of elderly in its population, which is projected to grow through 2060**

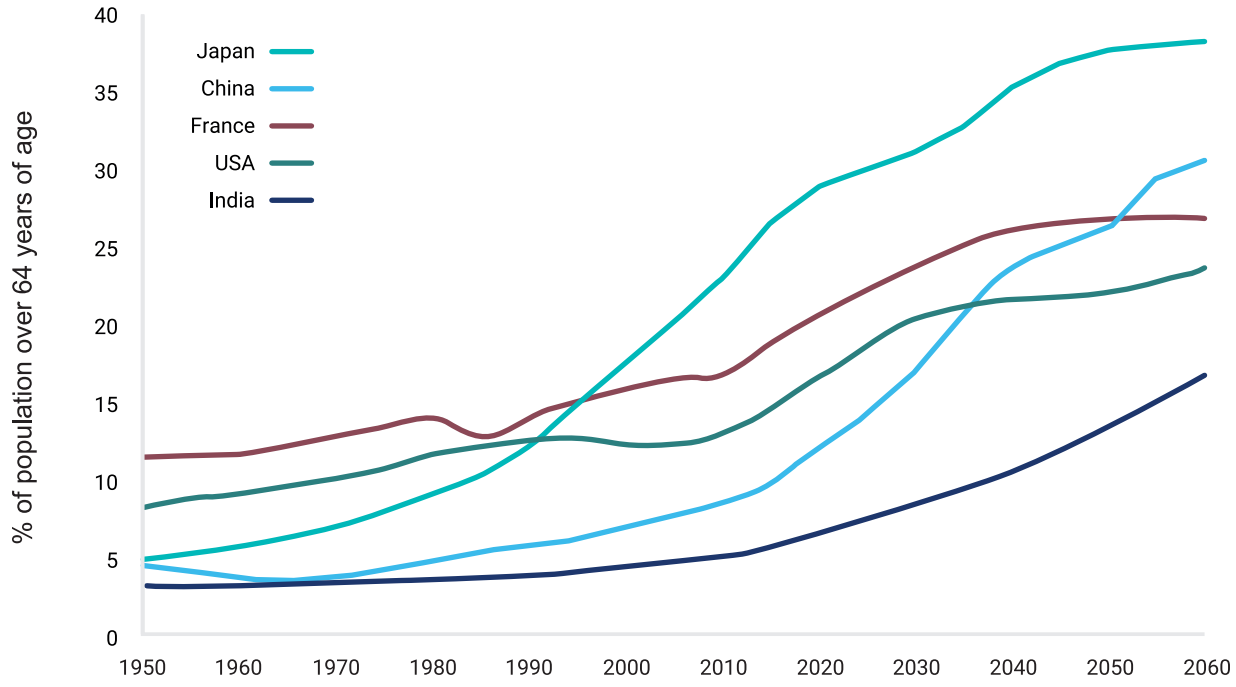
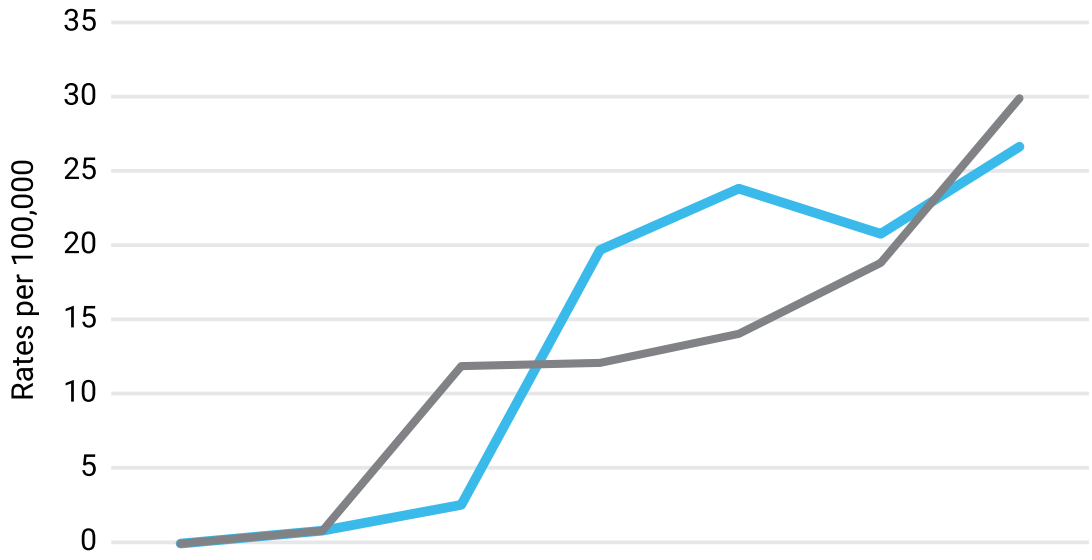


Figure 18. **Trends in self-harm rates across age groups, 2016**



Age, years	0–4	5–14	15–29	30–49	50–59	60–69	70+
Japan	0	0.87	2.50	19.74	23.87	20.77	26.55
Global	0	0.79	11.76	11.99	14.03	18.89	29.86

Mortality rates attributed to self-harm for all ages globally and in Japan. Data for calculations extracted from global health estimates: Deaths by cause, age, sex, by country and by region, 2000–2016. Global mortality rates exclude Japan from the calculations.

Mental health disorder and suicide burden

Figure 18 shows the distribution of mortality rates related to self-harm, comparing global rates to Japan-specific rates. Self-harm mortality rates were similar between groups for individuals aged 5–14 and 60 years and over. However, there was a surge in self-harm mortality rates in Japan for those within the 30–49 and 50–59 age groups. In fact, self-harm rates for ages 30–60 in Japan surpass global trends.

Based on the above, the strategy to reduce NCD burden in Japan consists of a two-pronged approach:

- Achieve healthy aging: Improving behavior changes by tackling solutions to promote healthy aging
- Disease-specific strategy: Focusing on tackling mental illness to reduce the burden of suicide

Russia: Disease-specific strategy (CVD)

In Russia, where the GNI is less than US$12,500, CVD causes 55% of premature deaths and is the highest contributor to the NCD burden (based on local analysis).[8] As a result, the government is seeking to reduce CVD mortality by 23% by 2024, setting this as a high health priority.

Aligning with this governmental goal, Upjohn's CVD-specific strategies include increasing awareness of primary and secondary prevention. To improve patient outcomes, HCPs are educated on evidence-based treatment guidelines in collaboration with local cardiovascular societies. Upjohn is advocating for the inclusion of prevention strategies into the national guidelines.

SPOTLIGHT

on healthy aging in the European Union

Upjohn is partnering with the European Commission through the European Innovation Partnership on Active and Healthy Ageing (EIP on AHA) to develop innovative solutions to address healthy aging through Project CHANGE (Clinical practice-oriented cHange solutions towards Active aNd healthy aGEing). Project CHANGE's objective is to identify solutions to improve healthy aging and reduce the burden of NCDs.

EIP ON AHA
PARTNER

A summary of the first phase of the project, published in the journal *Aging Clinical and Experimental Research*, is titled "Information and communication technology for increasing healthy aging in people with noncommunicable diseases: identifying challenges and further areas for development."[132]

This first phase has identified several priority areas, including improving treatment adherence interventions; development and increased use of integrated care models; increasing awareness to manage NCDs at the patient, family, and caregiver level; and increasing patient engagement and empowerment.

Healthy aging is a key objective for decreasing the burden of NCDs in HICs given the unique demographics in these countries. One major priority is the use of information and communication technology (ICT) for assessment, management, integration, and follow-up of patients with NCDs. The second phase of the project involves selecting and implementing ICT improvements to advance care for European populations with NCDs.

Key points	
	The SNAP framework enables a systematic approach for establishing focused partnerships.
	Upjohn has established strategic partnerships that can amplify its voice as a leader in the fight against NCDs.

08

Upjohn collaborations and partnerships

Anchored by the SNAP framework, Upjohn has set up focused relationships with key external stakeholders. This approach aims to engage with stakeholders both globally and regionally (Figure 19).

As outlined in section 6, stakeholders play a key role in working in unison to alleviate the burden of NCDs. Optimized partnerships across relevant stakeholders and sectors contribute to effective prevention and reduction of risk factors that inevitably lead to the development of overt NCDs. Through these partnerships, Upjohn can leverage the expertise, ideas, passion, resources, and assets from each organization to create greater benefits and access for the patient. These partnerships are critical for the patient and vital to help combat the global burden of NCDs.

The NCD Alliance works to promote the development of capabilities across countries and regions to aid in the recognition of the burden and treatment of NCDs. Upjohn is working in partnership with the NCD Alliance to develop and publish evidence on proven, cost-effective solutions involving health workers to improve health systems for NCD prevention and care.

In Japan, Upjohn is working with Minacare to analyze real-world data, initially looking at the quality of long-term care. The aim of this initiative is to understand and influence behavior to improve patient quality of life and reduce Japan's NCD burden, with the ambition to treat an additional 2.25 million Japanese patients by 2025. Upjohn is also working with the Health and Global Policy Institute to raise awareness of the concept of NCDs in Japan and drive the understanding of the impact of NCD comorbidities in the aging population by 2025.

Upjohn has started a partnership with the C3 network. Webinars are used to train community nurses so they can help improve the management of hypertension and mental illness, as well as increase their awareness of drug misuse/abuse. Principally based in the UK, the C3 network has over 3,000 members across more than 85 countries.

Achieving our goal of helping

225

million

new patients by 2025

Figure 19. **Upjohn's NCD partnerships organized by strategy and geography**

Source: Upjohn Research, Development and Medical, 2019


NEW

09
Conclusion

The world is constantly changing—technologies emerge; economies shift; populations grow and evolve. Many elements change in harmony, while others meet in confrontation. What is undeniable is that humanity is highly sensitive to the macro environment. So enters the NCD crisis of today. NCDs as a category have been gaining public attention over the past decade, notably in 2015, when they surpassed infectious diseases as the leading cause of death worldwide. Today, NCDs are responsible for 71% of all deaths, with the associated morbidity taking significant tolls on both individual quality of life and global economies.

This public health crisis is the result of a perfect storm of culminating factors: behavioral choices, environmental pollution, aging populations, and great progress in the management of infectious diseases. Optimistically, many of the risk factors associated with NCDs can be modified, suggesting people can reverse their trajectory. Doing so will require a groundswell of action across multiple sectors and individual citizens alike—action on a level yet to be reached. Efforts must be targeted, collaborative, and pervasive to ensure significant and lasting progress. Drawing a parallel between NCDs and the HIV movement of the last century, efforts should also be relentless and emotionally charged for the personal toll they take on our communities.

Improvements in healthcare systems are paramount in effective management of NCDs. Today, patients are faced with fragmented systems, lack of coordination across HCPs, gaps in access to PCPs who have been adequately trained in NCDs, and little influence over their treatment.

The burden of NCDs is evident across high-, middle-, and low-income countries. However, there are distinct differences among regions, which suggests the need for targeted intervention strategies. Demonstrating a commitment to country-specific strategies and strong collaboration with inter-sectoral partners, Upjohn has developed the Strategic Segmentation for NCD Country Action Plans (SNAP). This framework is designed to provide tailored solutions, by country, that address specific unmet needs. It leverages robust data from the WHO and local authorities to segment markets in a simple and repeatable manner, thus optimizing intervention strategies based on a country's policy readiness and NCD burden. Such is an example of the private sector owning its role in what must be a cohesive mission across sectors to reduce the burden of NCDs.

Much has been accomplished since the United Nations first published a set of voluntary targets for countries that share the mission to reduce NCD-related mortality by 30% by 2030, and there is much more to do. With the will and aspiration to combat this public health crisis, Upjohn is committed to being a leader in the private sector by relieving the burden of NCDs with trusted quality medicines for every patient, everywhere. If communities and organizations lead with their respective strengths while standing united in this fight, it is possible to reverse the grim trajectory of NCDs.

10
References

1. World Health Organization. Global Health Observatory (GHO) Data. NCD Mortality and Morbidity. Available at https://www.who.int/gho/ncd/mortality_morbidity/en/ (accessed July 8, 2019).

2. World Health Organization. Noncommunicable Diseases. 2018. Available at https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases (accessed July 22, 2019).

3. Population Reference Bureau. Global Burden of Noncommunicable Diseases. Washington, DC. 2019. Available at https://www.prb.org/noncommunicable-diseases (accessed July 22, 2019).

4. World Health Organization. Disease Burden and Mortality Estimates. Available at https://www.who.int/healthinfo/global_burden_disease/estimates/en/ (accessed July 10, 2019).

5. World Heart Federation. White Paper: Driving Sustainable Action for Circulatory Health. 2018. Available at https://www.world-heart-federation.org/resources/white-paper-for-circulatory-health (accessed July 16, 2019).

6. World Health Organization. Cancer: Data and statistics. 2019. Available at http://www.euro.who.int/en/health-topics/noncommunicable-diseases/cancer/data-and-statistics (accessed July 22, 2019).

7. World Health Organization. Global Surveillance, Prevention and Control of Chronic Respiratory Diseases. A Comprehensive Approach. 2007. Available at https://apps.who.int/iris/bitstream/handle/10665/43776/9789241563468_eng.pdf;jsessionid=A904EE4C1BAF9A010C76F1E5721E9681?sequence=1 (accessed July 22, 2019).

8. World Health Organization. Noncommunicable Diseases Country Profiles 2018. 2018. Available at https://www.who.int/nmh/publications/ncd-profiles-2018/en/ (accessed July 10, 2019).

9. World Health Organization. Noncommunicable Diseases (NCDs) and Mental Health: Challenges and Solutions. Available at https://www.who.int/nmh/publications/ncd-infographic-2014.pdf?ua=1 (accessed July 16, 2019).

10. The World Bank. World Bank Country and Lending Groups. 2019. Available at https:// datahelpdesk.worldbank.org/knowledgebase/articles/906519 (accessed July 22, 2019).

11. World Health Organization. Available at http://gamapserver.who.int/mapLibrary/Files/Maps/Global_NCD_mortality_under70_both_sexes_2015.png (accessed September 23, 2019).

12. Lisy K, Campbell JM, Tufanaru C, Moola S, Lockwood C. The prevalence of disability among people with cancer, cardiovascular disease, chronic respiratory disease and/or diabetes: a systematic review. *Int J Evid Based Healthc*. 2018; 16 (3): 154-66.

13. Tuzun H, Aycan S, Ilhan MN. Impact of comorbidity and socioeconomic status on quality of life in patients with chronic diseases who attend primary health care centres. *Cent Eur J Public Health*. 2015; 23 (3): 188-94.

14. Lam CL, Lauder IJ. The impact of chronic diseases on the health-related quality of life (HRQOL) of Chinese patients in primary care. *Fam Pract*. 2000; 17 (2): 159-66.

15. Ha NT, Duy HT, Le NH, Khanal V, Moorin R. Quality of life among people living with hypertension in a rural Vietnam community. *BMC Public Health*. 2014; 14 (1): 833.

16. Kruk ME, Nigenda G, Knaul FM. Redesigning primary care to tackle the global epidemic of noncommunicable disease. *Am J Public Health*. 2015; 105 (3): 431-7.

17. GBD 2017 SDG Collaborators. Measuring progress from 1990 to 2017 and projecting attainment to 2030 of the health-related Sustainable Development Goals for 195 countries and territories: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018; 392 (10159): 2091-138.

18. Hunter DJ, Reddy KS. Noncommunicable diseases. *N Engl J Med*. 2013; 369 (14): 1336-43.

19. Bloom DE, Cafiero ET, Jané-Llopis E, et al. The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum; 2011.

20. Global Burden of Disease Study Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015; 386 (9995): 743-800.

21. Kessler RC, Bromet EJ. The epidemiology of depression across cultures. *Annu Rev Public Health*. 2013; 34: 119-38.

22. United Nations. Sustainable Development Goal 3. 2019. Available at https://sustainabledevelopment.un.org/sdg3#targets (accessed July 30, 2019).

23. GBD 2017 Disease and Injury Incidence Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018; 392 (10159): 1789-858.

24. Goldberg DS, McGee SJ. Pain as a global public health priority. *BMC Public Health*. 2011; 11: 770.

25. International Association for the Study of Pain. Unrelieved Pain is a Major Global Healthcare Problem. 2019. Available at http://s3.amazonaws.com/rdcms-iasp/files/production/public/Content/ContentFolders/GlobalYearAgainstPain2/20042005RighttoPainRelief/factsheet.pdf (accessed July 30, 2019).

26. Long AN, Dagogo-Jack S. Comorbidities of diabetes and hypertension: mechanisms and approach to target organ protection. *J Clin Hypertens* (Greenwich). 2011; 13 (4): 244-51.

27. Kerr EA, Heisler M, Krein SL, et al. Beyond comorbidity counts: how do comorbidity type and severity influence diabetes patients' treatment priorities and self-management? *J Gen Intern Med*. 2007; 22 (12): 1635-40.

28. Cohen BE, Edmondson D, Kronish IM. State of the art review: depression, stress, anxiety, and cardiovascular disease. *Am J Hypertens*. 2015; 28 (11): 1295-302.

29. Batelaan NM, Seldenrijk A, Bot M, van Balkom AJ, Penninx BW. Anxiety and new onset of cardiovascular disease: critical review and meta-analysis. *Br J Psychiatry*. 2016; 208 (3): 223-31.

30. Vancampfort D, Correll CU, Galling B, et al. Diabetes mellitus in people with schizophrenia, bipolar disorder and major depressive disorder: a systematic review and large scale meta-analysis. *World Psychiatry*. 2016; 15 (2): 166-74.

31. Stein DJ, Benjet C, Gureje O, et al. Integrating mental health with other non-communicable diseases. *BMJ*. 2019; 364: l295.

32. Chen S, Kuhn M, Prettner K, Bloom DE. The macroeconomic burden of noncommunicable diseases in the United States: estimates and projections. *PLoS One*. 2018; 13 (11): e0206702.

33. BodenheimerT, Chen E, Bennett HD. Confronting the growing burden of chronic disease: can the U.S. health care workforce do the job? *Health Aff* (Millwood). 2009; 28 (1): 64-74.

34. Bloom DE, Eggleston KN. The economic implications of population ageing in China and India: introduction to the special issue. *J Economics Ageing*. 2014; 4: 1-7.

35. Zhu XL, Luo JS, Zhang XC, Zhai Y, Wu J. China's efforts on management, surveillance, and research of noncommunicable diseases: NCD scorecard project. *Ann Glob Health*. 2017; 83 (3-4): 489-500.

36. Cuijpers P, Vogelzangs N, Twisk J, Kleiboer A, Li J, Penninx BW. Comprehensive meta-analysis of excess mortality in depression in the general community versus patients with specific illnesses. *Am J Psychiatry*. 2014; 171 (4): 453-62.

37. Simon GE, VonKorff M. Suicide mortality among patients treated for depression in an insured population. *Am J Epidemiol*. 1998; 147 (2): 155-60.

38. World Health Organization. Mental Health Action Plan 2013-2020. 2013. Available at https://www.who.int/mental_health/action_plan_2013/bw_version.pdf (accessed July 22, 2019).

39. World Health Organization. Mental Health, Suicide Data. 2019. Available at https://www.who.int/mental_health/prevention/suicide/suicideprevent/en/ (accessed August 14, 2019).

40. World Health Organization. Depression Key Facts. 2018. Available at https://www.who.int/news-room/fact-sheets/detail/depression (accessed July 5, 2019).

41. Stuart H. Reducing the stigma of mental illness. *Glob Ment Health* (Camb). 2016; 3: e17.

42. Unutzer J, Park M. Strategies to improve the management of depression in primary care. *Prim Care*. 2012; 39 (2): 415-31.

43. World Health Organization. World Mental Health Day - 10 October. 2019. Available at https://www.who.int/mental_health/world-mental-health-day/en/ (accessed July 22, 2019).

44. World Health Organization. Depression and Other Common Mental Disorders: Global Health Estimates. World Health Organization, Geneva. 2017. Available at https://apps.who.int/iris/bitstream/handle/10665/254610/WHO-MSD-MER-2017.2- eng.pdf (accessed July 22, 2019).

45. World Health Organization. Global Status Report on Noncommunicable Diseases. Description of the Global Burden of NCDs, Their Risk Factors and Determinants. 2010. Available at https://www.who.int/nmh/publications/ncd_report2010/en/ (accessed July 8, 2019).

46. O'Keefe LM, Taylor G, Huxley RR, Mitchell P, Woodward M, Peters SAE. Smoking as a risk factor for lung cancer in women and men: a systematic review and meta-analysis. *BMJ Open*. 2018; 3 (8): 10.

47. World Health Organization. WHO Global Report on Trends in Prevalence of Tobacco Smoking 2000-2025 - Second Edition. 2018. Available at https://www.who.int/tobacco/publications/surveillance/trends-tobacco-smoking-second-edition/en/ (accessed July 9, 2019).

48. Pruss-Ustun A, van Deventer E, Mudu P, et al. Environmental risks and non-communicable diseases. *BMJ*. 2019; 364: l265.

49. World Health Organization. Global Health Observatory (GHO) Data: Ambient Air Pollution. 2019. Available at https://www.who.int/gho/phe/outdoor_air_pollution/en/ (accessed August 14, 2019).

50. World Health Organization. Public Health, Environmental and Social Determinants of Health (PHE). 2019. Available at https://www.who.int/phe/health_topics/outdoorair/global-exposure-assessment-faq/en/ (accessed July 22, 2019).

51. World Health Organization. Global Health Observatory (GHO) Data: Prevalence of Insufficient Physical Activity. 2019. Available at https://www.who.int/gho/ncd/risk_factors/physical_activity_text/en/ (accessed July 22, 2019).

52. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants. *Lancet Glob Health*. 2018; 6 (10): e1077-e86.

53. Webber L, Kilpi F, Marsh T, Rtveladze K, Brown M, McPherson K. High rates of obesity and non-communicable diseases predicted across Latin America. *PLoS One*. 2012; 7 (8): e39589.

54. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet*. 2017; 390 (10113): 2627-42.

55. World Health Organization. Obesity and Overweight. 2018. Available at https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight (accessed August 11, 2019).

56. World Health Organization. Management of Substance Abuse. Global Status Report on Alcohol and Health 2018. Available at https://www.who.int/substance_abuse/publications/global_alcohol_report/en/ (accessed July 9, 2019).

57. The Lancet Diabetes & Endocrinology [Editorial]. Urbanisation, inequality, and non-communicable disease risk. *Lancet Diabetes Endocrinol.* 2017; 5 (5): 313.

58. Eurostat. Causes of Death Statistics - People Over 65. 2019. Available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Causes_of_death_statistics_-_people_over_65#Frequency_of_the_main_causes_of_death_in_the_EU_for_the_elderly_and_for_younger_people (accessed August 11, 2019).

59. McDonald KM, et al. Care coordination. In: Shojania KG McDonald KM, Wachter RM, Owens DK, eds. Closing the quality gap: a critical analysis of quality improvement strategies. Vol 7. Stanford University-UCSF Evidence-based Practice Center, Agency for Healthcare Research and Quality; 2007.

60. Basile J, Houston M, Ferrario C. Incremental risk-factor reduction improves overall cardiovascular benefit: is it time to abandon the silos? *J Clin Hypertens* (Greenwich). 2006; 8 (10): 686-8.

61. Vaidya A. Communicating the role of academia in the control of noncommunicable diseases: identification, involvement and institutionalization. *Health Prospect*. 2015; 13 (2): 28-9.

62. Chen LM, Farwell WR, Jha AK. Primary care visit duration and quality: does good care take longer? *Arch Intern Med*. 2009; 169 (20): 1866-72.

63. Beaglehole R, Epping-Jordan J, Patel V, et al. Improving the prevention and management of chronic disease in low-income and middle-income countries: a priority for primary health care. *Lancet*. 2008; 372 (9642): 940-9.

64. Bodenheimer T. Coordinating care—a perilous journey through the health care system. *N Engl J Med*. 2008; 358 (10): 1064-71.

65. Poureslami I, Nimmon L, Rootman I, Fitzgerald MJ. Health literacy and chronic disease management: drawing from expert knowledge to set an agenda. *Health Promot Int.* 2017; 32 (4): 743-54.

66. Roser M, Ritchie H. Burden of Disease. 2019. Available at https://ourworldindata.org/burden-of-disease (accessed July 8, 2019).

67. Dye C. After 2015: infectious diseases in a new era of health and development. *Philos Trans R Soc Lond B Biol Sci.* 2014; 369 (1645): 20130426.

68. United Nations. World Population Ageing [Highlights]. 2017. Available at https://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2017_Highlights.pdf (accessed July 10, 2019).

69. World Health Organization. Noncommunicable Diseases: the Slow-motion Disaster. Geneva: World Health Organization; 2017. Available at https://www.who.int/publications/10-year-review/ncd/en/ (accessed July 10, 2019).

70. United Nations. Population Facts. 2012. Available at https://www.un.org/en/development/desa/population/publications/pdf/popfacts/popfacts_2012-1.1.pdf (accessed July 8, 2019).

71. Kontis V, Mathers CD, Bonita R, et al. Regional contributions of six preventable risk factors to achieving the 25 x 25 non-communicable disease mortality reduction target: a modelling study. *Lancet Glob Health.* 2015; 3 (12): e746-57.

72. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med.* 2006; 3 (11): e442.

73. Mather M, Jacobsen LA, Pollard KM. Population Bulletin: Aging in the United States. Population Reference Bureau. 2015. Available at https://www.prb.org/wp-content/uploads/2016/01/aging-us-population-bulletin-1.pdf (accessed July 10, 2019).

74. He W, Goodkind D, Kowal P. An Aging World: 2015. 2016.

75. England K, Azzopardi-Muscat N. Demographic trends and public health in Europe. *Eur J Public Health.* 2017; 27 (suppl_4): 9-13.

76. Sowa A, Tobiasz-Adamczyk B, Topor-Madry R, Poscia A, la Milia DI. Predictors of healthy ageing: public health policy targets. *BMC Health Serv Res.* 2016; 16 Suppl 5: 289.

77. Khan R, Socha-Dietrich K. Investing in medication adherence improves health outcomes and health system efficiency: adherence to medicines for diabetes, hypertension, and hyperlipidaemia. OECD Health Working papers. Paris: OECD Publishing; 2018: 105.

78. MendittoE, Cahir C, Aza-Pascual-Salcedo M, et al. Adherence to chronic medication in older populations: application of a common protocol among three European cohorts. *Patient Prefer Adherence.* 2018; 12: 1975-87.

79. Briesacher BA, Andrade SE, Fouayzi H, Chan KA. Comparison of drug adherence rates among patients with seven different medical conditions. *Pharmacotherapy*. 2008; 28 (4): 437-43.

80. Farmaindustria Espana. Plan de Adherencia al Tratamiento. Uso responsable del medicamento. Available at https://www.sefac.org/sites/default/files/sefac2010/private/documentos_sefac/documentos/farmaindustria-plan-de-adherencia.pdf (accessed July 10, 2019).

81. Population Reference Bureau. Noncommunicable Diseases Among Older Adults in Low- and Middle-Income Countries. 2012. Available at https://www.prb.org/noncommunicable-diseases-older-adults-2/ (accessed July 16, 2019).

82. Nikolic IA, Stanciole AE, Zaydman M. Chronic Emergency: Why NCDs Matter. World Bank. 2011. Available at https://openknowledge.worldbank.org/bitstream/handle/10986/13591/639270WP0Chron0Box0361533B00PUBLIC0.pdf?sequence=1&isAllowed=y (accessed July 16, 2019).

83. Moran A, Gu D, Zhao D, et al. Future cardiovascular disease in China: Markov model and risk factor scenario projections from the coronary heart disease policy model-China. *Circ Cardiovasc Qual Outcomes*. 2010; 3 (3): 243-52.

84. United Nations. Population 2030. 2015. Available at https://www.un.org/en/development/desa/population/publications/pdf/trends/Population2030.pdf (accessed July 10, 2019).

85. China Power Team. Does China Have an Aging Problem? 2016. ChinaPower. Available at https://chinapower.csis.org/aging-problem (accessed July 10, 2019).

86. Bloom DE, Cafiero-Fonseca ET, McGovern ME, et al. The macroeconomic impact of non-communicable diseases in China and India: estimates, projections, and comparisons. *J Economics Ageing*. 2014; 4: 100-11.

87. The World Bank. Smoking Prevalence, Males (% of Adults). Available at https://data.worldbank.org/indicator/SH.PRV.SMOK.MA; Females (% of Adults) https://data.worldbank.org/indicator/SH.PRV.SMOK.FE (accessed July 10, 2019).

88. Min Y, Jiang LX, Yan LJ, et al. Tackling China's noncommunicable diseases: shared origins, costly consequences and the need for action. *Chin Med J* (Engl). 2015; 128(6): 839-43.

89. Wang Z, Chen Z, Zhang L, et al. Status of hypertension in China: results from the China Hypertension Survey, 2012-2015. *Circulation*. 2018; 137 (22): 2344-56.

90. Pfizer. Annual Report 2015. 2016. https://www.pfizer.com/files/investors/financial_reports/annual_reports/2015/assets/pdfs/pfi2015ar-global-reach.pdf (accessed July 10, 2019).

91. World Health Organization. Towards a Global Action Plan for Healthy Lives and Well-Being for All. 2018. Available at https://apps.who.int/iris/bitstream/handle/10665/311667/WHO-DCO-2018.3-eng.pdf (accessed July 10, 2019).

92. Centers for Disease Control and Prevention. How We Prevent Chronic Diseases and Promote Health. 2018. Available at https://www.cdc.gov/chronicdisease/center/nccdphp/how.htm (accessed July 22, 2019).

93. Venkatapuram S, McKee M, Stuckler D. Ethical tensions in dealing with noncommunicable diseases globally. *Bull World Health Organ.* 2012; 90 (3): 241-2.

94. World Health Organization. Social Determinants of Health. Priority Public Health Conditions scoping paper. 2007. Available at https://www.who.int/social_determinants/publications/pphc_scoping_paper/en/ (accessed July 9, 2019).

95. Gillman MW. Primordial prevention of cardiovascular disease. *Circulation*. 2015; 131 (7): 599-601.

96. Vaduganathan M, Venkataramani AS, Bhatt DL. Moving toward global primordial prevention in cardiovascular disease: the heart of the matter. *J Am Coll Cardiol.* 2015; 66 (14): 1535-7.

97. Gaye B, Lloyd-Jones DM. Primordial prevention of cardiovascular disease: several challenges remain. *Int J Cardiol*. 2019; 274: 379-80.

98. Mello MM, Gostin LO. Commentary: a legal perspective on diabetes surveillance—privacy and the police power. *Milbank Q*. 2009; 87 (3): 575-80.

99. Bousquet J, Anto JM, Sterk PJ, et al. Systems medicine and integrated care to combat chronic noncommunicable diseases. *Genome Med.* 2011; 3 (7): 43.

100. Manji I, Pastakia SD. Novartis Access: a small step towards increased access for non-communicable disease care. *Lancet Glob Health*. 2019; 7(4): e398-e9.

101. Vetrano DL, Calderon-Larranaga A, Marengoni A, et al. An international perspective on chronic multimorbidity: approaching the elephant in the room. *J Gerontol A Biol Sci Med Sci*. 2018; 73 (10): 1350-6.

102. Ormseth CH, Sheth KN, Saver JL, Fonarow GC, Schwamm LH. The American Heart Association's Get With the Guidelines (GWTG)-Stroke development and impact on stroke care. *Stroke Vasc Neurol*. 2017; 2 (2): 94-105.

103. Paulus RA, Davis KA, Steele GD. Continuous innovation in health care: implications of the Geisinger Experience. *Health Aff* (Millwood). 2008; 27 (5): 1235-45.

104. Mishra SR, Lygidakis C, Neupane D, et al. Combating non-communicable diseases: potentials and challenges for community health workers in a digital age, a narrative review of the literature. *Health Policy Plan*. 2019; 34 (1): 55-66.

105. Gizurarson S, Bjornsdottir LR, Einarsdottir R, Halldorsson M, Andersen K. Clinical consequences following regulatory changes in respect to reimbursement of statins cost by the Icelandic Social Insurance Administration. *Scand J Public Health*. 2012; 40 (7): 663-7.

106. World Health Organization. Saving Lives, Spending Less: A Strategic Response to Noncommunicable Diseases. 2018. Available at https://www.who.int/ncds/management/ncds-strategic-response/en/ (accessed July 16, 2019).

107. United Arab Emirates Government. Vision 2021. 2019. Available at https://www.vision2021.ae/en (accessed July 22, 2019).

108. Global Health Council NCD Roundtable. Building MultiStakeholder Partnerships for NCDs: Ideas, Steps and Actions. 2010. Available at http://globalhealth.org/wp-content/uploads/ghc_Multi-stakeholder-engagement-for-NCDs_final.pdf (accessed July 30, 2019).

109. The World Bank. Civil Society. Available at https://www.worldbank.org/en/about/partners/civil-society (accessed July 10, 2019).

110. World Economic Forum. Who and What is 'Civil Society?' 2018. Available at https://www.weforum.org/agenda/2018/04/what-is-civil-society/ (accessed July 17, 2019).

111. United States Pharmacopeial Convention (USP). Homepage. 2019. Available at https://www.usp.org/ (accessed July 22, 2019).

112. NCD Alliance. Making NCD prevention and Control a Priority, Everywhere. 2017. Available at https://ncdalliance.org/ (accessed July 16, 2019).

113. World Health Organization. Governments Commit to Reduce Suffering and Deaths From Noncommunicable Diseases. 2017. Available at https://www.who.int/news-room/detail/18-10-2017-governments-commit-to-reduce-suffering-and-deaths-from-noncommunicable-diseases (accessed July 16, 2019).

114. National Institute for Health Research (NIHR). £25 Million Funding Awarded to Leading Disease Prevention Projects. Available at https://www.nihr.ac.uk/news/25-million-funding-awarded-to-leading-disease-prevention-projects/20324 (accessed July 10, 2019).

115. Brazilian Ministry of Health, Health Surveillance Secretariat. Strategic Action Plan to Tackle Noncommunicable Diseases (NCD) in Brazil 2011-2022. Brasilia. 2011. Available at https://www.iccp-portal.org/system/files/plans/BRA_B3_Plano%20DCNT%20-%20ingl%C3%AAs.pdf (accessed July 22, 2019).

116. United Nations General Assembly. Political Declaration of the Third High-Level Meeting of the General Assembly on the Prevention and Control of Noncommunicable Diseases. New York. 2018. Available at https://www.who.int/ncds/governance/third-un-meeting/en/ (accessed July 22, 2019).

117. World Health Organization. Noncommunicable Diseases: Campaign for Action – Meeting the NCD Targets. Available at https://www.who.int/beat-ncds/take-action/targets/en/ (accessed July 16, 2019).

118. World Health Organization. Global Coordination Mechanism on the Prevention and Control of NCDs. 2014. Available at https://www.who.int/global-coordination-mechanism/background/en/ (accessed July 30, 2019).

119. World Health Organization. HIV Treatment and Care. Treat All: Policy Adoption and Implementation Status in Countries. 2017. Available at https://apps.who.int/iris/bitstream/handle/10665/259532/WHO-HIV-2017.58-eng.pdf;jsessionid=823D227A273E4F423291E9F19F221305?sequence=1 (accessed August 12, 2019).

120. Juma K, Reid M, Roy M, et al. From HIV prevention to non-communicable disease health promotion efforts in sub-Saharan Africa: a Narrative Review. *AIDS*. 2018; 32 Suppl 1: S63-S73.

121. Aylward B. Polio Will Soon be History. World Health Organization. 2007. Available at https://www.who.int/bulletin/volumes/85/07-100107/en/ (accessed July 10, 2019).

122. Bloom DE, Chen S, McGovern ME. The economic burden of noncommunicable diseases and mental health conditions: results for Costa Rica, Jamaica, and Peru. *Rev Panam Salud Publica.* 2018; 42: e18.

123. Global Burden of Disease. *Lancet*. Available at https://www.thelancet.com/gbd (accessed July 10, 2019).

124. World Health Organization. Policies, Strategies and Action Plans: Data by Country. Available at http://apps.who.int/gho/data/view.main.2473 (accessed July 10, 2019).

125. Ministry of Health Government of Malaysia. Clinical Practice Guideline on Management of Hypertension. 5th Edition. Kuala Lumpur. 2018. Available at http://www.acadmed.org.my/view_file.cfm?fileid=894 (accessed July 10, 2019).

126. Wilcox S, Altpeter M, Anderson LA, et al. The healthy aging research network: resources for building capacity for public health and aging practice. *Am J Health Promot*. 2013; 28 (1): 2-6.

127. Brown MT, Bussell JK. Medication adherence: WHO cares? *Mayo Clin Proc*. 2011; 86 (4): 304-14.

128. Cutler RL, Fernandez-Llimos F, Frommer M, Benrimoj C, Garcia-Cardenas V. Economic impact of medication non-adherence by disease groups: a systematic review. *BMJ* Open. 2018; 8 (1): e016982.

129. Haynes RB, Montague P, Oliver T, McKibbon KA, Brouwers MC, Kanani R. Interventions for helping patients to follow prescriptions for medications. *Cochrane Database Syst Rev*. 2000 (2): CD000011.

130. Muramatsu N. Japan: super-ageing society preparing for the future. *Gerontologist*. 2011; 51 (4): 425-32.

131. Ministry of Internal Affairs and Communication SB. *Japan Statistical Yearbook*, Chapter 2: Population. 2018.

132. Monaco A, Maggi S, De Cola P, Hassan TA, Palmer K, Donde S. Information and communication technology for increasing healthy aging in people with non-communicable diseases: identifying challenges and further areas for development. *Aging Clin Exp Res*. 2019; 31 (11): 1689-93.

NCD WHITE PAPER

2020