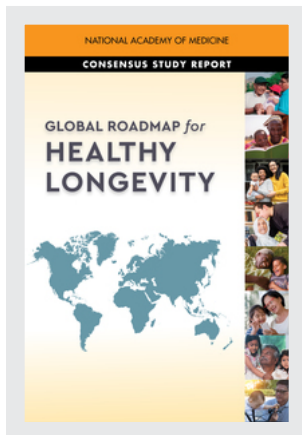# Global Roadmap for Healthy Longevity (2022)

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ISBN 978-0-309-47150-3 | DOI 10.17226/26144

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National Academy of Medicine 2022. *Global Roadmap for Healthy Longevity*. Washington, DC: The National Academies Press. https://doi.org/10.17226/26144.

GLOBAL ROADMAP *for*
HEALTHY
LONGEVITY

Commission for a Global Roadmap for Healthy Longevity

NATIONAL ACADEMY OF MEDICINE

THE NATIONAL ACADEMIES PRESS
Washington, DC
www.nap.edu

Suggested citation: National Academy of Medicine. 2022. *Global Roadmap for Healthy Longevity.* Washington, DC: The National Academies Press. https://doi.org/10.17226/26144.

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vi

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This Consensus Study Report was reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. The purpose of this independent review is to provide candid and critical comments that will assist the National Academies of Sciences, Engineering, and Medicine in making each published report as sound as possible and to ensure that it meets the institutional standards for quality, objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

We thank the following individuals for their review of this report:

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Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations of this report nor did they see the final draft before its release. The review of this report was overseen by **JO IVEY BOUFFORD,** School of Global Public Health, New York University, and **ERIC B. LARSON,** Kaiser Permanente Washington. They were responsible for making certain that an independent examination of this report was carried out in accordance with the standards of the National Academies and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authoring commission and the National Academies.

Foreword

If you knew you could remain healthy for 10, 20, or even 30 more years, how would your plans change? How would your life change? How would the lives of your loved ones change?

It is well known that people across the globe are living longer. By 2030, for the first time in recorded history, the old will begin to outnumber the young.[1] This demographic shift could result in more vibrant societies worldwide, as older people contribute to their communities and the economy for more years. However, in many cases, these latter years are currently quite challenging and include contention with chronic disease, increasing frailty, a fragmented health care system, and a society that is not currently oriented to care for the aging. As individual life spans have increased, the years of *unhealthy* life have also increased. Very few countries have made significant progress to prepare financially, socially, and scientifically for longer and healthier life spans.

It does not have to be this way. Mitigating the challenges posed by and for the global aging population will require broad, systematic change and deliberative action across basic and translational science; clinical medicine and health care; personal, social, economic, and environmental determinants; and policy and financing. Innovative solutions are needed to improve overall health, productivity, and quality of life for the aging population.

To better understand the scope of this challenge and identify these innovative solutions, the National Academy of Medicine (NAM) assembled an independent international commission of experts to author this authoritative, evidence-based

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[1] See https://healthylongevitychallenge.org/about-us.

ix

report with recommendations that can be applicable for diverse societies world-wide to guide effective solutions for healthy aging and longevity. The commission assessed the existing and projected risks, challenges, and opportunities presented by global aging, and its deliberations have resulted in a roadmap to foster healthy longevity through strategies related to the social and behavioral enablers of health, health care and public health systems, and science and technology.

This study underscores the fact that humanity needs to fundamentally shift how we are preparing for population aging to maximize the number of years lived in good health—not simply extend the number of years lived. To ensure that additional years of life are meaningful, the report identifies social infrastruc-ture as a necessary foundation. Reducing ageism, improving social cohesion, ensuring financial security, and boosting digital literacy are all critical aspects in ensuring that society is prepared to support individuals as they age. Reimagining the physical environment of our cities and communities, including housing and neighborhoods, improving access to public transportation, and combating climate change are critical to help ensure that people are able to live independently for more years.

Many health systems were developed at a time when life expectancy was approximately 50 to 70 years; since then, health systems have both struggled and not been properly incentivized to adapt to better care for people who are regularly living more than 70 years. Adapting our health systems to be able to care for the health of older people, specifically considering the impact and cost of chronic conditions, providing value-based health care, improving public health, investing in improvements to long-term care and geroscience, and utilizing big data and advanced analytics to better understand and implement preventive care will be critical in ensuring that the additional years individuals are living are universally healthier.

Helping people live longer and more fulfilling lives also makes economic sense. Experts predict that longer lives will contribute to financial growth across many sectors. An explicit focus on reimagining and empowering an aging work-force, supporting education and training across the life span, and broadening op-tions for formal and informal volunteering will ensure that as people live longer, they continue to contribute to both society and the economy.

As we work, collectively, to allow all persons to live longer, with purpose and dignity, we must also ensure that these revolutionary advances are distributed equitably across all populations worldwide. If only some of us are living longer and healthier lives, we have not achieved the necessary goal of improving how we all age.

I am grateful to the commissioners for their tremendous contributions to this report over the past 3 years, while they were simultaneously addressing the impacts of COVID-19 in their home countries. When the pandemic emerged in early 2020, the commission actually paused its deliberations for a year. When the group reconvened, all of the members returned with a better understanding of

the unique vulnerabilities of older adults highlighted by COVID-19, the perverse inequities in populations around the world, and the interconnected nature of our global society.

I would like to thank the members of the International Oversight Board that had authority over the commission's membership, statement of task, and dissemination efforts; and would like to acknowledge the hard work and dedication of the many NAM staff who have contributed to this effort, most notably Maureen Henry, Emma Lower-McSherry, and Samantha Chao. I would finally like to thank the sponsors of the report itself, whose ongoing support has made this report possible. In addition, I would like to thank a public-spirited donor, wishing to remain anonymous, for supporting the dissemination of this study.

Global aging is one of the defining challenges of this century. It will fundamentally impact how families, communities, societies, industries, and economies function. This report describes an ambitious all-of-society approach that will be necessary to revolutionize our current approaches to caring for the aging—and in implementing this approach, all of society will benefit. We have the opportunity to start designing more equitable societies that enable all people to live healthier, longer lives. Immediate movement on this work will only benefit us all, sooner.

Victor J. Dzau, M.D.
President, National Academy of Medicine
May 2022

Preface

One of humankind's greatest achievements in the past century has been the extension of life span in every society. Coincident with falling birth rates, the world now has more people over the age of 60 than under 5, and in many countries, those over 60 will constitute 40 percent of the population by 2050.

Like climate change, demographic change is unprecedented, and will remain so for the foreseeable future, impacting the way we live, learn, work, and play; and all dimensions of the human experience. It will shape jobs, economies, and national budgets. In some societies, this change is occurring faster than others but will eventually affect everyone during their lifetime. How we now plan for life in the older age most people and societies have never had before will determine whether the outcome is an optimistic one for all, or the negative one many forecast. Fortunately, much can and must be done to ensure that societies are aging societies that are thriving and robust. This is the motivation of this report and the basis for its recommendations.

The commission was formally constituted in 2019 with members from countries representing both the North and South, East and West. Our disciplines range across science, medicine, public health, health care systems, engineering, technology, and policy. We have benefited substantially from expertise shared at our three public workshops on the social, behavioral, and environmental determinants; the health and health care systems needed; and how science and technology can enable our vision for 2050 and beyond, and from input by global economists.

The commission is aligned on the following:

xiii

- A recognition that all societies were created for a length of life half of what we will have by 2050.
- Substantial evidence supports the immense opportunity for all from longer lives, but an intentional whole of society transformation will be required to achieve these opportunities and to ensure equity in this achievement.
- The capabilities of longer lives could be a basis for societal thriving if healthy longevity is achieved. Investments in healthy longevity could extend health span for the vast majority and also support the needs we all are challenged by with older age.
- Commensurate with these longer healthy lives, older adults having the opportunities for paid work and volunteering, enabling them to assume roles to contribute to a better future for their community and family, will further contribute to well-being.
- Coalescence around the importance and urgency of this issue that changes everything else—for better or worse, depending on how societies respond.
- Timing to create the changes needed is important; there is urgency to start these changes now so as to not forfeit the opportunities, and to support human needs in our longer lives.
- The observation that unless low- and middle-income countries put aging at the center of their development agendas, these agendas are at substantial risk of not achieving their goals.

Our report envisions what societies could look like in 2050 if we applied all that we know on how societies can remain robust and even thrive because of, not just despite, demographic change. This is the basis of our "Future-Back Vision," supported with evidence where available, and otherwise with expert opinion.

This will require us to revisit our current life stages, and instead of compartmentalization into phases of learning, working, and then retirement, consider a blended journey, where the elements of learning, working, and leisure are intertwined from early adulthood to as long as these are valued. We are heartened that a significant number of older people globally wish to remain engaged for what they can contribute to society.

This will also require significant investments, but the benefits and returns from this in human, social, and economic capital will more than justify the expenditure. This will be detailed in the chapters that follow. These investments are arguably the strongest protection we have against the fears that demography will dictate destiny.

This report builds on and reinforces recent critical efforts, especially the United Nations *Decade of Healthy Ageing* (2021–2030). The report aims to provide a roadmap for leaders across societies to extend health span and identify

what actions will be required to ensure the success of their community as they become aging societies. Central to this success would be the need for societies to address their social compact and accomplish equity.

COVID-19 impacted the content, progress, and writing of this report. The commission planned three workshops and had just concluded their second, on Health Care and Public Health Systems for Healthy Longevity in February 2020, before global travel restrictions came into force. This was the last in-person meeting of the commission. The commission paused in April 2020, as members were involved in dealing with the pandemic, and formally restarted in May 2021. During this hiatus, we had a change of the National Academy of Medicine (NAM) supporting staff, initially led by Cecilia M. Shah, V. Ayano Ogawa, Peak Sen Chua, T. Anh Tran, Jarrett Nguyen, Stephen Chukwurah, Bridget Kelly, and Margaret Hawthorne. After the restart, they were succeeded by Maureen Henry, Johanna Gusman, Emma Lower-McSherry, Samantha Chao, and Megan Snair, supported by Morgan Kanarek. We are grateful for your superb leadership, expertise, and contributions.

In mid-2021, Dr. Jennie Popay stepped down from the commission, and Drs. Andrew Scott and Yaohui Zhao were appointed to the commission. The report greatly benefited from Dr. Popay's contributions, especially as co-chair of the Workshop on Social, Behavioral, and Environmental Enablers for Healthy Longevity, and endorses her strong vision on the importance of enhancing equity to achieve healthy longevity.

During the hiatus, the co-chairs continued discussions with each of the commissioners through video conferencing, and when the commission was formally reconstituted, commissioners made every effort to join meetings despite time zone differences. When recurrent COVID-19 waves hit countries at different times of the year, commissioners continued to contribute despite the demands of their day jobs.

We are deeply indebted to the dedication of this superb team, who shifted seamlessly from life prior to COVID-19 to organizing the third public workshop in June 2021 on Science and Technology for Health Longevity as a virtual global meeting. To say that everyone went above and beyond what would normally be expected is no exaggeration, dedicated to the shared conviction that the world needs to be, and can be, better prepared for this unprecedented demographic change of population aging.

The development of a vision for a successful future of aging societies, which is powered by longer lives with health and meaningful engagement, purpose, and dignity, involved substantial review of the evidence supporting this goal. This has created a shared optimism that this positive future is quite possible for all, but dependent on visionary and committed leadership aligned across all sectors toward individual and societal thriving through healthy longevity. This will require initial actions, some evolutionary and some transformational, as proposed in this

report, and then sustaining progress to 2050. With these actions taken, the aging of society could be the basis for both a longevity dividend for our economies and a previously unimagined Third Demographic Dividend for societies.

The commission is grateful to all who made this report possible: our International Oversight Board, NAM, participants of the three workshops, input from experts around the world, and the reviewers.

We would like to especially honor Dr. Tadataka "Tachi" Yamada, a global health giant in academia, industry, and philanthropy who was a driving force in the creation of this commission. His legacy will live on in all of us and this report, which we hope will reflect his appreciation of the power of science and knowledge to make this a better world for all.

Linda P. Fried and John Eu-Li Wong, *Co-Chairs*
Commission for a Global Roadmap for Healthy Longevity

Dedication

The commission dedicates this report to Tadataka "Tachi" Yamada who passed away in August 2021. Tachi was a driving force in the development of the National Academy of Medicine's (NAM's) Healthy Longevity Global Grand Challenge. He co-chaired the work that led to the creation of the Grand Challenge and co-chaired the Workshop on Science and Technology. We thank him for his immeasurable contributions to NAM.

Acknowledgments

Contents

xxi

Boxes, Figures, and Tables

BOXES

xxiii

FIGURES

TABLES

Summary[1]

Older people[2] are an increasing natural resource. In the past century, the world's population of people over age 65 has grown more rapidly than other age groups due to rising life spans and declining birth rates. This growth is expected to continue into the future, although the decline in life expectancy across many countries adds uncertainty to predictions made before the COVID-19 pandemic. Today's older people already make substantial contributions to their families and communities, and with healthy longevity, even more will do the same in the future. Despite the value that older people bring to society, however, governments and the news media characterize global aging as a tsunami that will overwhelm governments and consume resources needed for younger people to thrive. One concern is real: as life spans have increased, so too have *unhealthy* years of life, which can increase reliance on government health and social service programs while also contributing to individual suffering.

Healthy longevity is the state in which years in good health[3] approach the biological life span, with physical, cognitive, and social functioning that enables well-being across populations. By increasing healthy longevity, societies can minimize societal and individual burdens while increasing human and social capital. Promoting healthy longevity for individuals and societies through policies

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[1] This Summary does not include references. Citations for the discussion presented in the Summary appear in the subsequent report chapters.

[2] "Older people" applies to people in the second half of their life, depending on the life expectancy where they reside. As people age, the prevalence of age-related conditions climbs. The onset of age-related chronic conditions is about 10 years later in high-income versus low-income countries.

[3] This report uses the World Health Organization's definition of health: "a state of complete physical, mental, and social well-being."

1

and actions can unleash the potential of older people in the near and long terms, benefiting people of all ages and societies around the globe.

Now is the time for a movement toward healthy longevity. In the past century, the number of older people has grown to make up a larger number and share of the global population than ever in the past, and the trend is predicted to continue. While some countries are seeing rapid aging, all countries will need to create structures and climates to support health and promote productive engagement in society among all people.

Age is the greatest risk factor for developing chronic conditions, which are responsible for most mortality and disability worldwide, but science is providing insights into how to delay the onset of aging and chronic conditions. Among the most effective interventions for delaying aging and chronic conditions are addressing negative social determinants of health population-wide, for example by ceasing tobacco use, increasing physical activity, and consuming a healthy diet. Additionally, scientific advances and technologies are enabling the development of promising therapeutics to delay aging processes and support people facing functional or cognitive decline.

A GLOBAL ROADMAP FOR HEALTHY LONGEVITY

This report is a product of the National Academy of Medicine's (NAM's) Healthy Longevity Global Grand Challenge. To create a roadmap for healthy longevity, NAM convened an international, independent, and multidisciplinary expert commission charged with creating a roadmap for global healthy longevity to translate demographic change into opportunity.

The roadmap starts with a set of overarching principles for healthy longevity. To operationalize these principles, it then includes long-term goals for longer and healthier lives in 2050 and supporting structures to achieve those goals, together with recommendations for catalyzing change toward healthy longevity (see Figure S-1). These goals, structures, and recommendations span four domains: the longevity dividend (i.e., work, volunteering, and education), social infrastructure, physical environment, and health systems. Within each domain, the commission focused on key targets to catalyze change. The commission selected key targets based on actionability, impact on people across the life course, equity, and importance to (1) improving healthy longevity in the long term and (2) tackling needs of older people in the near term. It focused the report on essential actions in specific sectors with potential to generate multisector, all-of-society transformation. The key targets are not the only areas in need of attention for healthy longevity by 2050; rather, they are starting points. Cross-cutting themes include the need for a life-course approach, equity, social cohesion accompanied by a strong social compact, the role of science and technology, and the need to measure progress toward the healthy longevity goals.

Overarching Principles for Healthy Longevity

1. People of all ages, particularly older adults, reach their full potential to live life with good health, functioning, meaning, purpose, and dignity.
2. Societies enable the best health and functioning that individuals at all ages are capable of attaining.
3. Societies reduce disparities and enhance equity within and among countries to realize the well-being and contributions of all people, including those of older ages.
4. The human, financial, and social capital of older people is realized for the benefit of all of society.
5. Societies use data and meaningful metrics to track the achievement of outcomes and guide decision making.

Recommendations for the Next 5 Years	Supporting Structures to Achieve the Goals	Long-Term Goals for Longer and Healthier Lives in 2050
2022 - 2027	**2022 - 2050**	**2050**

FIGURE S-1 A roadmap for achieving healthy longevity.

The commission recognized that healthy longevity requires multiple complex systems working together and the political, fiscal, cultural, and other factors that will facilitate, rather than challenge, a future of healthy longevity. Some efforts will need governmental funding, while others will not. All actors in the pursuit of healthy longevity, shown in Figure S-2, will inevitably face competing demands for time and resources. Healthy longevity will require all-of-society involvement, but the commission emphasizes the importance of including older people in designing systems for healthy longevity and of anchoring action in the community.

The commission's roadmap aligns with other overlapping global efforts currently under way, including the United Nations (UN) Decade of Healthy Ageing and the UN Sustainable Development Goals (SDGs). By strengthening institutional structures that enable good health across the life course, governments can also make progress toward achieving the SDGs.

The commission anchored the roadmap in a vision for a realistic and optimistic future with healthy longevity. In that vision, healthy longevity triggers a virtuous cycle (see Figure S-3) whereby it both benefits from and enables a lifetime with meaning, social engagement, learning, and growth. Together, health and productive engagement build social, human, and financial capital. Increased capital, in turn, fuels the systems that support health, social needs, the physical environment, education, and productive engagement through work and formal or informal volunteering, and these systems, collectively, support health and produc-

FIGURE S-2 Relevant actors for an all-of-society approach to healthy longevity.

tive engagement. Major disrupters of this virtuous cycle include ageism, disease, poverty, pollution, and inequity. Societies with healthy longevity are expected to thrive with a new social compact based on social cohesion and equity.

The roadmap provides a path from fear of global aging to a future that thrives on global aging. While much of the focus is on addressing challenges facing older people, many of the interventions to achieve healthy longevity benefit people of all ages. When older people thrive, all people thrive.

The commission faced several challenges in creating an evidence-based global roadmap for healthy longevity. No country has achieved sustained healthy longevity. Moreover, scientific evidence for precisely how to do so is unproven, although empirical evidence and case studies reveal promising pathways, which serve as the basis for the commission's findings, conclusions, and recommendations. The commissioners emphasized the urgency of proactive experimentation and innovation guided, not limited, by evidence and monitored using metrics, rigorous evaluation, and continuous improvement. At the same time, the commission recognized that not everything important for healthy longevity can be measured objectively. If societies wait for academic evidence and standardization before taking action to achieve healthy longevity, the world will be stuck in the status quo.

The need to address healthy longevity is universal, but the best pathway for moving the agenda forward in every corner of the world is not. To address the challenge of limited evidence, the commission relied on evidence from global reports; multicountry systematic reviews; and when necessary, single studies
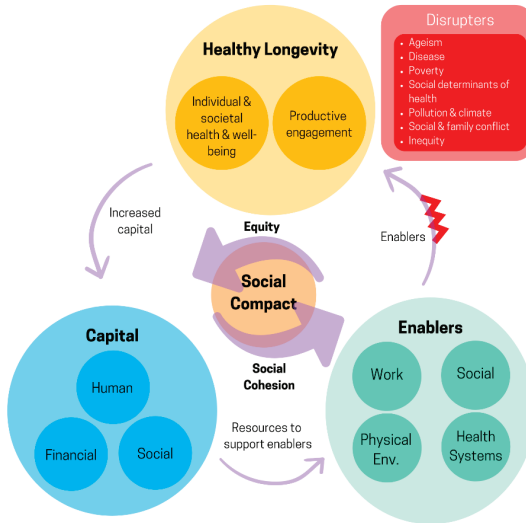
FIGURE S-3 The virtuous cycle of healthy longevity.

representing a small fraction of the global population and individual case studies of promising interventions.

The heterogeneity within communities, countries, and global regions posed additional challenges. Beyond the evidence, political, economic, social, and environmental forces and resources vary widely around the world. This variation is particularly poignant and challenging in a world facing existential crises, such as climate change, a global pandemic, and threats to global political stability that will compete for the same resources needed to improve healthy longevity. In the face of these challenges, the need to access all societal resources is urgent, and older people are currently a largely untapped resource—hence the commitment to initiating change through the roadmap.

THE LONGEVITY DIVIDEND

As life spans increase over time and older adults make up a larger proportion of the population than they have in the past, societies have the opportunity to reap gains if good health is maintained for more of the years of life than has thus far been the case. If longer lives in good health are combined with the structures needed to enable healthier older adults to be productively engaged in life, society and individuals of all ages will benefit. The longevity dividend roadmap (see Figure S-4) describes components needed to initiate change to benefit all.

Increasing longevity means that people in many countries will need to work longer than they do today to avoid national fiscal and economic challenges and to

Longevity Dividend Key Targets

Work and retirement, volunteering, and lifelong education and retraining

2022 - 2027

Recommendations for Next 5 Years

(full text at end of relevant section within Chapter 3)

3-1. Design work environments and develop new policies that enable and encourage older adults to remain in the workforce
3-2. Prioritize investments to redesign education systems to support lifelong learning and training; invest in the science of learning and training for middle-aged and older adults

2022 - 2050

Examples of Supporting Structures

- Increased older-adult participation in the paid workforce and volunteer roles to maintain individual and societal economic equilibrium with population aging
- Incentives to recruit and retain older workers to increase workforce participation, emphasizing the worker's preferences, strengths, and capabilities
- Policies and incentives to keep older people working and remove barriers to remaining in or rejoining the workforce
- Formal programs to provide volunteers with meaning and purpose through opportunities to benefit communities and the next generation
- Development and adoption of a range of innovative and age-appropriate pedagogical approaches that work for people of all ages
- Expanded access to secondary education, vocational training, and higher education to train and upskill workers of all ages

2050

Goals

1. Economic and social benefits generated by people living, working, volunteering, and engaging longer
2. Social infrastructure, institutions, and business systems that enable safe and meaningful work and other community engagement at every stage of life
3. Education and training opportunities that promote participation in lifelong learning and growth

FIGURE S-4 Longevity dividend roadmap.

maintain personal financial security. An immediate counterpoint to this assertion is that older people will take jobs away from younger people, but the evidence suggests that, when older people work instead of retiring, younger people are more likely to have jobs and are less likely to be unemployed.

The commission concludes that healthy longevity will contribute to growth in gross domestic product (GDP), personal savings, and government coffers. Beyond supporting healthy longevity by addressing social and health needs of

people across the life course, governments and the private sector can support opportunities for older people's productive engagement, including work, volunteering, caregiving, and other unpaid roles in the community and family.

Labor Force Participation

To maintain current standards of living over longer lives in the face of demographic change, people will need to be healthier and engaged longer. The commission argues that increasing workforce participation among people over age 50 in high-income countries by giving people who have the desire or need to work the opportunity to do so is the best way to harness healthy longevity in service to those countries' economies. This strategy will offset predictions that larger populations of older people will harm economies.

Raising the age at which older people can access pensions increases workforce participation among older people but can force low-income older people to work longer, even in the face of health problems more common among workers with physically demanding jobs. Raising the retirement age may also leave older workers unemployed and ineligible for a pension should age discrimination prevent them from being hired or remaining employed. Alternatively, removing structural barriers (e.g., age discrimination and implicit taxes on wages earned after retirement age) that prevent people from working as long as they want and establishing incentives to encourage people to work have historically increased workforce participation.

Decisions to continue working at later ages are driven by what people need, want, and are healthy enough to do and whether employers will retain, train, or hire them. Pension eligibility, the need or desire for more income, and satisfaction and accomplishment in work can keep people in the workforce. Conversely, people leave the workforce earlier than planned because of poor health, job loss without replacement, family caregiving responsibilities, and physically grueling work environments. Employers can make employment more attractive than retirement by allowing people to transition incrementally into retirement. Governments can eliminate mandatory age-based retirement, provide incentives for job retraining, and reduce cost barriers to working longer.

The commission encourages a choice-based approach to increasing workforce participation, given the evidence that removing barriers and providing incentives to work are effective. In contrast, increasing the pension eligibility age, though effective, can increase disparities and penalize those who may be unable to work for the reasons stated above. The commission acknowledges that many people globally are ineligible for pensions and even social support and health care benefits because they work in the informal sector and, increasingly in high-income countries, in the gig economy. The commission believes that society-wide healthy longevity will not be achieved if large numbers of people

are ineligible for pensions and other benefits because they work outside the formal economy.

Volunteering

Also important to the longevity dividend and intergenerational cohesion is formal and informal volunteering, which brings meaning, purpose, and satisfaction to older people. Volunteering by older people also contributes to value in society, and evidence suggests that it improves health and well-being among volunteers; for a large, national school-based program, it was also found to be beneficial for students. Many older people wish to contribute to society, often motivated by a desire to help younger generations.

Volunteering also brings tangible value to society. One analysis estimated that the value of paid work and a subset of all volunteering by people over age 50 in Europe and the United States was 29 percent and 40 percent, respectively, of GDP per capita. The value of these contributions is actually greater because the analysis did not include the value of household activities or caregiving for an adult in the same household.

In light of the above findings, the commission points out that expanded efforts by private- and public-sector organizations to actively encourage volunteering, especially in roles that strengthen intergenerational cohesion and the social compact, would bring value to societies.

Lifelong Education and Retraining

Education from early ages has multiple positive effects on healthy longevity, including health and financial well-being. Experts predict that in a future characterized by healthy longevity, people will undergo multiple career transitions across their working lives, which will necessitate multiple cycles of education, retraining, and upskilling. Current education and training systems are not designed to meet the needs of middle-aged and older workers, so restructuring will be necessary. Examples of structures that can strengthen education opportunities include pedagogical approaches appropriate for people of all ages and multiple modalities to suit different learning preferences.

SOCIAL INFRASTRUCTURE FOR HEALTHY LONGEVITY

The importance of social determinants of health has increasingly been recognized, but across many countries, spending focuses on other priorities, such as health care, and not on unmet social needs. Because of the scope and scale of unmet needs, the commission identified key targets for social infrastructure that impact healthy longevity and challenges posed by aging societies (see Figure S-5).

Social Infrastructure Key Targets

Prosocial strengths of older people, ageism and age discrimination, social inclusion, financial security in retirement, and digital literacy

2022 - 2027

Recommendations for Next 5 Years

(full text at end of relevant section within Chapter 4)

4-1. Develop evidence-based strategies to reduce ageism
4-2. Develop plans to ensure basic financial security for older people
4-3. Develop strategies for increasing financial literacy

2022 - 2050

Examples of Supporting Structures

- Laws and policies to eliminate age-based discrimination
- Public information campaigns promoting the value of older people and attacking stereotypes
- Multigenerational advocacy to fight age discrimination to accomplish shared goals
- Multigenerational approach to policy and action to strengthen social cohesion, reduce loneliness
- Pension and social protection systems that include people outside the formal economy
- Programs promoting individual savings and financial literacy
- Access to secure banking systems and investment opportunities

2050

Goals

4. Social cohesion augmented by intergenerational connections and the creation of opportunities for purposeful engagement by older people at the family, community, and societal levels
5. Social protections and financial security that mitigate the effects of financial vulnerability at older ages

FIGURE S-5 Social infrastructure roadmap.

Prosocial Strengths of Older People

Advancing age is associated with increased motivation to contribute to other people, younger generations, society, and the greater good. Moreover, older people's experience, knowledge, and emotional stability hold the potential to build the social and human capital needed to create and perpetuate healthy longevity. Efforts to foster social connections and build cohesion start in local communities, where informal caregiving for family members, neighbors, and acquaintances is the norm.

Ageism and Age Discrimination

Ageism—the only "ism" that all people will experience if they live long enough—affects every aspect of life for older people. Structural and individual age discrimination is a barrier to healthy longevity and productive engagement. Successful efforts to combat ageism around the globe have used multipronged, multisector approaches, such as those combining law, policy, and media. Intergenerational collaboration has been an essential component of several successful programs.

Social Inclusion

The common characterization of older people as isolated and alone overstates the reality. Most older people have strong social and family ties that keep family members connected and engaged in supporting adult children and grandchildren. Other activities, through religious and community organizations, work, and volunteering, are also important to social connectedness. At the same time, many older adults experience loneliness. An estimated 20–34 percent of older adults in China, Europe, Latin America, and the United States identify as lonely. Some lack social networks, which can lead to isolation and loneliness whose effects on mortality and health risks rival in magnitude those of smoking, alcohol misuse, and obesity. During the COVID-19 pandemic, advice in some countries intended to keep people safe from illness inadvertently increased exposure to these risks. Evidence-based programs to reduce loneliness and strengthen family, community, and social ties can be scaled and replicated, and these programs can be complemented by digital tools and multigenerational communities that hold promise for helping to combat loneliness.

Financial Security in Retirement

The commission encourages providing basic financial security for older people where current supports are inadequate or nonexistent. Designing for societies of longer, healthier lives requires resources to support the financial needs of older people. Healthy longevity requires financial security for older people because they have few options for improving their financial security, especially when in poor health. Societies can adopt successful models for providing financial support to older people, some solely government-funded and others involving incentives to encourage private savings. The latter programs likely will require universal access to secure banking systems and investment opportunities.

Digital Literacy

Technological advances have left many older adults behind, although digital literacy among older people will increase over time as people who have used digital technology from childhood enter older ages. The public and private

sectors, including civic organizations, can support digital literacy for all people. An emphasis on user-centered design will make future digital interfaces more user-friendly, and lifelong digital training opportunities and affordable digital access will narrow the digital divide for older people.

PHYSICAL ENVIRONMENT

The physical environment is the locus for many of the social determinants of health. The physical environment can enable or impede healthy longevity by affecting social engagement and cohesion, safety, physical activity, and access to essential needs. Within the physical environment is a complex interplay of multilevel environmental risks, including those associated with climate change, access to services and community institutions, the built environment (i.e., spaces, buildings, products created or modified by people), and the natural environment. The commission's roadmap for the physical environment is shown in Figure S-6.

Physical Environment Enablers Key Targets

Housing, public spaces and infrastructure, transportation, digital technologies, and climate change & environmental hazards

2022 - 2027

Recommendations for Next 5 Years

(full text at end of Chapter 5)

5-1. Design user-centered and cohesion-enabling intergenerational communities for healthy longevity

2022 - 2050

Examples of Supporting Structures

- Inclusion of older people in codesign and user-centered design of the built environment
- Public spaces that promote social cohesion and intergenerational connection, while also encouraging physical activity
- Age-friendly community and housing design protocols that enhance access to food, transportation, social services, and engagement
- Programs to mitigate the effects of environmental emergencies on older people
- Reduction of air pollution

2050

Goals

6. Physical environments and infrastructure that support functioning and engagement for people at older ages

FIGURE S-6 Physical environment enablers roadmap.

Housing

Safe and affordable housing is critical to quality of life; health and safety; and for older people and people with disabilities, the ability to remain independent. For many older people, living independently in their community is a personal goal. Key considerations for housing include universal design; affordability; health and safety; and water, sanitation, and hygiene. Including people in the codesign of housing is important to ensure that it suits their needs. Finally, the proximity of a living space to food and resources plays an important role in healthy longevity. Investments in housing can contribute to healthy longevity and provide a return on investment.

Public Spaces and Infrastructure

Public spaces and community infrastructure affect mobility, which influences people's ability to interact with other people within families, communities, and regions. Multiple neighborhood resources, such as parks, places to sit, and public transportation, are valuable for all residents, and for older people, they encourage active travel. Intentional design of public spaces can strengthen social cohesion, promote urban health and citizen well-being, and support the local economy. Because of their links with healthy longevity, the commission emphasizes the need for green space, walkability, and safety.

Transportation

Transportation is fundamental to the ability to move around, access services, and engage in social activities and work. The availability of public transportation, particularly important in low- and middle-income countries, has significant impacts on people of all ages. Limitations in public transportation options can impact everything from a person's ability to stay engaged in the community to access to health services, which have negative effects on health. Driving a personal vehicle is an important mode of transportation, but loss of physical and cognitive capacity renders many older people unable to drive. The level of access to transportation options can be limited by infrastructure and personal financial resources. Improved options for transportation include universal design in cars; innovative design of railways and buses that removes barriers to getting on and off and sitting; installation of bus shelters, benches, and street lighting at stations; and provision of mobility aids for crossings at bus stops to enhance safety.

Digital Technologies

Interactions with businesses, health care systems, and educational institutions are increasingly becoming digitized. Many advances in social infrastructure

and the physical environment are contingent on access to reliable internet and familiarity with digital devices. Benefits also include the ability to work remotely and social engagement. Inequity in access to modern, high-speed internet is a major differentiator among population groups, but, at the same time, digital access raises concerns about privacy and cybersecurity, including internet scams. The commission agrees with the many calls for expanded access to high-speed internet, especially in rural areas.

Climate Change and Environmental Hazards

The ongoing impacts of climate change constitute an urgent environmental challenge, as healthy longevity is not possible without a healthy planet. Recent studies predict that the frequency of extreme weather events will increase over the next three decades, with effects across the life course but disproportionate and near-term adverse effects on older people and people with disabilities. In addition to climate change, environmental stressors such as exposure to air pollution have greater adverse health effects on older people, particularly those already suffering from respiratory illness. The commission echoes the United Nations' best practices for engaging older people in disaster risk reduction strategies, providing financial support and social protections following emergencies, and reintegrating older adults back into normal life.

HEALTH SYSTEMS

Health systems will need to change to increase the efficiency and affordability of health care. As shown in Figure S-7, the commission's roadmap encourages shifts across all health systems to support healthy longevity.

The health of older people is heterogeneous. Most people over age 65 live independently, and only a minority have severe functional limitations. At the same time, by age 65 most people have multiple chronic conditions that affect their health. Aging processes increase the risk of chronic conditions, as well as functional and cognitive decline. These health conditions and impairments affect the ability to recover from infection and other health threats, as was demonstrated during the COVID-19 pandemic by the disproportionately high mortality rate among older people.

Public Health

Public health systems that promote population health across the life course will be critical to preventing or delaying chronic conditions. However, prevention spending across countries is disproportionately low compared with the need and with other health spending. In 2015, on average, approximately 2 percent of

Health Systems Key Targets

Chronic conditions; public health; health care delivery; long-term care; health care workforce; and geroscience, technology, and big data innovation

2022 - 2027

Recommendations for Next 5 Years

(full text at end of relevant section within Chapter 6)

6-1. Develop strategies to increase investments in robust public health systems

6-2. Shift health care systems to focus on healthy longevity

6-3. Make available culturally sensitive, person-centered, and equitable long-term care

2022 - 2050

Supporting Structures

All Health Systems
- Integration across public health, health care, long-term care, and social services

Public Health
- Interventions at population and individual level to reduce underlying risk factors for aging and chronic conditions
- Close collaboration with social service providers, workplaces, and other entities that can promote health
- Data and analytics systems for surveillance, precision public health, and assessment of the efficacy of interventions

Health Care
- Integrated person-centered care, including care coordination
- Primary care
- Comprehensive and shared health records and a goal-based care plan
- Collaboration with social services to address social determinants of health
- Primary care systems that provide preventive screening, address risk factors for chronic conditions, and promote positive health behaviors
- Geriatrics workforce that can adequately care for older people globally
- Palliative and hospice care

Long-Term Care
- Policy and funding prioritizes care delivery in the setting the person chooses, to the extent possible; respects individual autonomy and maintains dignity; and attends to care quality and the risk of abuse, neglect, and exploitation
- Care and social supports addressing all needs, including meaning and purpose
- Supports for families and family caregivers when providing long-term care while making formal care available when needed
- Technology to support caregivers and people needing care by providing monitoring that allows privacy

2050

Goals

7. Integrated public health, social service, person-centered health care, and long-term care systems designed to extend years of good health and support the diverse health needs of older people

8. Quality long-term care systems to ensure that people receive the care they require in the setting they desire for a life of meaning and dignity

FIGURE S-7 Health systems roadmap.

health spending by Organisation for Economic Co-operation and Development countries was for prevention.

The most effective strategy for prevention of population-wide chronic conditions involves addressing adverse effects of social determinants of health and unhealthy environments. Also effective is changing the context by making the healthy choice for behaviors with the greatest impact on health the easy choice. Preventing chronic conditions is most effective when public health agencies undertake multifaceted campaigns that include limits on advertising, public health and education messaging, taxes, financial incentives, and targeted community-based programs. Prevention focused on one disease at a time is less effective than efforts targeting the shared risk factors for biological aging and chronic conditions.

Effective prevention will require disaggregated data on health risk factors and health outcomes to enable "precision" public health strategies that include assessing risks to subpopulations and narrowly targeting interventions to groups that will benefit the most.

Achieving healthy longevity also will require strengthened public health systems and close collaboration with other organizations responsible for addressing health and social needs, including social service agencies, environmental safety agencies, employers, and labor unions. Programmatic components of public health systems with important roles in healthy longevity include interventions at the population and individual levels designed to reduce underlying risk factors for both aging and chronic conditions, as well as data and analytics systems for surveillance, precision public health, population-wide interventions, and evaluation.

Health Care

The commission argues that integrated, person-centered care (including behavioral health care) is the most appropriate care delivery model to maximize health for people across the life course and is essential for older people with multiple chronic conditions. Care focused separately on discrete conditions can actually harm older people, whereas care centered on an older person's goals provides a yardstick against which clinicians can measure the appropriateness of care options. Achieving healthy longevity will require that health policies and financing shift away from acute care and infectious disease models toward models that address chronic conditions and the need to create environments that maximize functional capacity.

Primary care is the most efficient mechanism for delivering high-quality, cost-effective care around the globe. The commission asserts, then, the critical importance of primary care that is as affordable and accessible as possible.

Physiology changes with age, as do health outcomes. Therefore, all providers who care for older people need basic training in geriatric medicine if they are to deliver high-quality care. Geriatric care models and guidelines have proliferated

with some evidence of success but with differences in desired outcomes and approaches (e.g., disease self-management versus caregiver support), making it difficult to compare results across studies. Barriers to the adoption and implementation of geriatric care models include the large number of competing models, the single-disease approach that dominates health care systems and financing, and the limited evidence of scalability.

Resolving these barriers will require long-term, transformational change. The commission contends that a number of structures need to be established for health care systems to promote healthy longevity, including

- integrated, person-centered care, as described by the World Health Organization (WHO), delivered by a provider who is responsible for coordinating a person's care across settings and, when possible, by an interdisciplinary team;
- mechanisms to promote collaborative relationships with social service providers, which can help address social determinants of health at the individual level;
- comprehensive and shared health records that include a care plan based on the person's goals, preferences, and values;
- health care systems that leverage data systems to inform individual and population care, monitor quality, and identify effective therapeutics and interventions for patient subpopulations;
- primary care systems that focus on prevention and care by carrying out essential screening, addressing risk factors for chronic conditions, implementing evidence-informed interventions to address health behaviors, and maintaining functional capacity;
- over time, the potential use of precision medicine to tailor the most effective therapeutics to individuals; and
- palliative care and hospice for people with high symptom burden and/or advanced illness, and structures to provide hospice care for those with late-stage illness.

Long-Term Care

Even with longer, healthier lives, long-term care, services, and supports will remain crucial for people with impaired capacity. Long-term care provides the care and functional support necessary to enable people with functional limitations to live with meaning and dignity. Long-term care is best provided in the setting preferred by the person, to the extent possible.

Family caregivers are more common than paid caregivers, but little is known about the adequacy of care provided by family or informal caregivers, except that many have minimal knowledge of how to care for an older person with functional limitations. While most people who receive care express gratitude for their care-

givers, abuse and neglect by caregivers is a concern globally, often associated with caregiver burden. The commission stresses the importance of establishing programs that support families and family caregivers and making formal care provision available where needed, thereby supporting the intersection between formal and family care.

Nursing homes are facility-based long-term care settings that provide care for the most impaired and vulnerable adults. Nursing homes have a troubled past in many countries, rife with allegations of abuse, neglect, and exploitation. The outsized effects of COVID-19 on nursing home residents highlight deficits in care quality and the challenges of keeping vulnerable people safe in institutional settings. These impacts have renewed calls to redesign long-term care systems while avoiding past challenges and meeting the needs of residents.

The commission points to the need for structures to ensure quality long-term care that addresses all human needs, not just personal and health care needs. For example, long-term care policies and funding that prioritize care delivery in the setting of the person's choice show respect for individual autonomy and the importance of maintaining dignity, with attention to care quality and the risk of abuse, neglect, and exploitation.

Health Care Workforce

WHO's *World Report on Ageing and Health* summarizes the inadequacy of geriatric training globally. A study of medical schools in 36 countries found that 27 percent of medical schools, including 19 percent in high-income countries, 43 percent in economies in transition, and 38 percent in other countries, provided no training in geriatric medicine. Medical trainees learn siloed, disease-based care, not the comprehensive biopsychosocial approaches needed to provide high-quality care to older people, especially those with complex needs. Other health care workers, especially those who provide direct services in low- and middle-income countries, also lack the training they need to provide high-quality care for this population.

A critical component of the care workforce for older people consists of those who provide personal care and other supports to people needing long-term care within and outside of facilities. This workforce is overwhelmingly female, often part of the informal economy, and typically very low wage. The commission believes that improving the future of long-term care will require training, safety protections, and adequate pay for these workers.

Geroscience, Technology, and Big Data Innovation

Data, scientific advances, and technological innovations in health are forging new frontiers in aging and therefore need to be considered in the design of future health systems. Governments and health systems now have access to an

unprecedented amount of data on many facets of people's lives and health. Harnessing the power of big data may enable targeted interventions matched to a community's specific public health prevention needs or to a person's individual care needs. However, these capabilities carry the risk of perpetuating historical biases or resulting in action based on statistical noise if data are not transparent and analyzed and evaluated with care.

Geroscience[4] is in the early phases of developing new and repurposing old therapeutic interventions to delay biological aging and prevent or slow the progression of chronic conditions. The development of effective interventions to change individual behaviors will require targeted epidemiologic, behavioral, and social science research. Academic institutions and biotech companies are already investigating targets for efforts to slow the aging process and prevent or delay chronic conditions, with potential interventions including new pharmaceuticals, intermittent fasting, use of stem cells, and regenerative medicine.

Wearables and passive monitoring hold promise for providing large datasets that can be used in conducting research or in tracking subclinical symptoms that can indicate health problems so measures can be taken to slow or prevent their progression. Smart home technology can provide the capability for unobtrusive monitoring to detect changes in biological function or falls, contingent on appropriate attention to concerns about privacy and including users in the codesign of products to ensure acceptability.

CONCLUSION

Older people currently contribute much to the world, and unleashing their potential through healthy longevity will enable them to contribute much more globally while allowing them to spend more of their later years in good health. Contributions and commitment from countries, communities, and people of all ages will be needed to realize the vision of a world of healthy longevity. If these efforts are successful, the possibilities are endless.

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[4] The goal of geroscience is to describe the age-related biological mechanisms that cause chronic conditions and functional decline, and to develop preventive and therapeutic interventions that can slow the aging process and prevent or delay the onset of chronic conditions that increase morbidity.

1

Introduction

Advances in science and technology targeting human longevity have proven that the way people age is not predetermined but malleable. Healthy longevity is defined in this report as follows:

In healthy longevity, years of good health approach the biological life span, with physical, cognitive, and social functioning that enables well-being.

As they age, more people in every country around the globe have the potential to live healthy lives, supporting a vision that people of all ages can live with meaning, purpose, and dignity. People can stay engaged with their families and communities, contribute to society, and lead enjoyable and productive lives well into their older years. The promise of extending the number of years lived in good health to accord with the increased life span achieved globally over the past century is closer to being realized than ever before. To achieve healthy longevity, a universal goal all societies need to be redesigned to support longer, healthier lives.

Health systems have generally been built to treat diseases. In many high-income countries, the heavy emphasis on acute- and hospital-centered care is poorly suited to promoting healthy longevity through prevention, screening, and management of chronic conditions. Middle- and low-income countries that are building health systems as their now young populations age can learn from and avoid the challenges faced by high-income countries today by thoughtfully balancing their limited resources between health promotion and health care to treat illness.

Across all countries, socioeconomic infrastructure supporting work and education typically emphasize achievements during the early years of life. And many physical environments are largely dominated by construction designed for able-bodied people living in the mid-20th century. Evidence shows that changes can be made to these systems to support healthier lives from birth to death. But unanswered questions remain about how to close the gap between current achievements in health and a vision of healthy longevity. Research is still needed to inform the specific configuration of such changes especially in the context of low- and middle-income countries. But incremental, concrete, evidence-based steps can be taken by governments, private-sector organizations, and communities around the world. This report sets out a roadmap including long-term goals and evidence-based recommendations for achieving those goals to move toward a future of global healthy longevity.

THE STATE OF DEMOGRAPHIC CHANGE GLOBALLY

Significant gains in longevity were achieved beginning in the 20th century in part as a result of advances in public health, including infrastructure (sanitation and water systems), food quality and safety, hygiene, immunizations and antibiotics, prenatal and maternity care, and medical care (Partridge et al., 2018). Increased physical security through protection from violence and conflict has also contributed to longer lives. In some countries, longevity has been driven by improved labor conditions and higher incomes. While these advances initially meant that more people had the opportunity to live longer, these gains in longevity have not necessarily come with similar gains in years lived in good health. On average globally, people now live longer than they did in 2000, but an increased number of people live longer with chronic conditions[1] and declining function and well-being, resulting in what some call a "decompression of morbidity" (Rowe and Berkman, 2022).

The benefits of increased longevity have not been equally shared, with disadvantaged populations experiencing neither the longevity nor the health gains of more privileged populations within countries, and significant differences in longevity from country to country (Permanyer and Scholl, 2019). Much of the evidence about trends in longevity presented throughout this report predates the onset of the COVID-19 pandemic, and evidence of its impact continues to emerge. A recent study of 37 upper-middle- and high-income countries showed increased life expectancy in only three countries, no change in two countries, and decreased life expectancy in the remaining 32 countries (Islam et al., 2021). Across the countries, 28.1 million more years of life were lost than expected.

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[1] This report uses the term "chronic conditions" to encompass distinct chronic diseases, multimorbidity (multiple chronic conditions in the same person), and geriatric syndromes (frailty, sarcopenia, polypharmacy, cognitive decline, disability, and falls) (Inouye et al., 2007).

Future trends in life expectancy are uncertain, and many trends described in this report (e.g., life expectancy, health status, employment trends) are in flux as a result of COVID-19.

Today the global population is projected to age rapidly as the result of two distinct trends: the rise in longevity and falling birth rates. Nearly 20 percent of the global population is estimated to be over age 65 by 2050, double the percentage in 2019, while the population aged 15–65 is predicted to rise by 20 percent. The contours of demographic change will be unique to each country and population around the world. Figures 1-1 through 1-3 show the dramatic rise in the population aged 65 and older as a percentage of the population in 1950, 2000, and 2050 (projected) in the world, Singapore, and Nigeria (note that the scales of the figures differ because of the dramatic differences in total population) (UN DESA, 2019a). The models show that the population of older people is increasing, but the patterns of population growth and aging over time differ, as indicated by the horizontal and vertical shapes of the graphs, respectively.[2] Typically, the wealthiest nations are furthest along in this demographic transition and have the highest proportion of older people, but the number of older people living in low- and middle-income countries is higher than the number in high-income countries. While many countries, such as Nigeria, currently have a large younger population, this large young cohort is projected to become a large old cohort. Therefore, an aging society is a reality for countries across income levels, with the only question being when they will become an aging society.

Differences in age structures create different challenges among countries in the near term, such as countries in sub-Saharan Africa that face high rates of youth unemployment while many high-income countries face a shrinking workforce. A country's challenges will drive how it allocates resources. Moreover, low- and middle-income countries will have few resources available to develop the systems needed for healthy longevity, such as health care and long-term care.

Nonetheless, to respond to this demographic shift, it will be imperative for countries to take steps, however incremental, to redesign society for longer lives, including how older people can engage with and contribute to family, community, and society.

In recent decades, the average household size in most countries has declined, and fewer people are living in multigenerational households, although this trend may have changed during the COVID-19 pandemic. In addition to these rapid demographic shifts, populations are changing, and demography will be influenced by climate change and rapid investments in information technology. Countries are also facing socioeconomic changes that are altering family structures and living arrangements, potentially putting older people at risk. Changes in fertility levels,

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[2] "Older people" applies to people in the second half of their life, depending on the life expectancy where they reside. As people age, the prevalence of age-related conditions climbs. The onset of age-related chronic conditions is about 10 years later in high-income versus low-income countries.
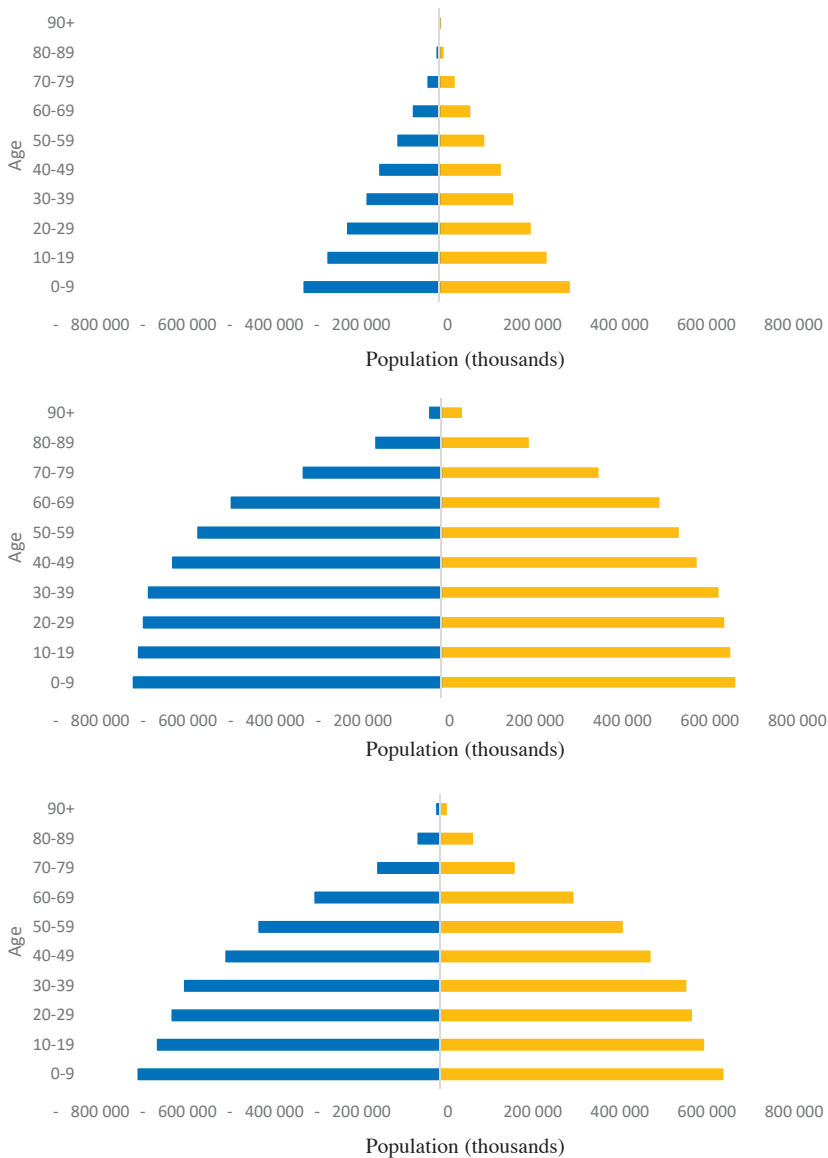
FIGURE 1-1 World population pyramid: 1950, 2020, and 2050.
NOTE: Blue = male population; yellow = female population.
SOURCE: UN DESA, 2019a. This work is licensed under a Creative Commons Attribution 3.0 IGO License (https://creativecommons.org/licenses/by/3.0/igo).
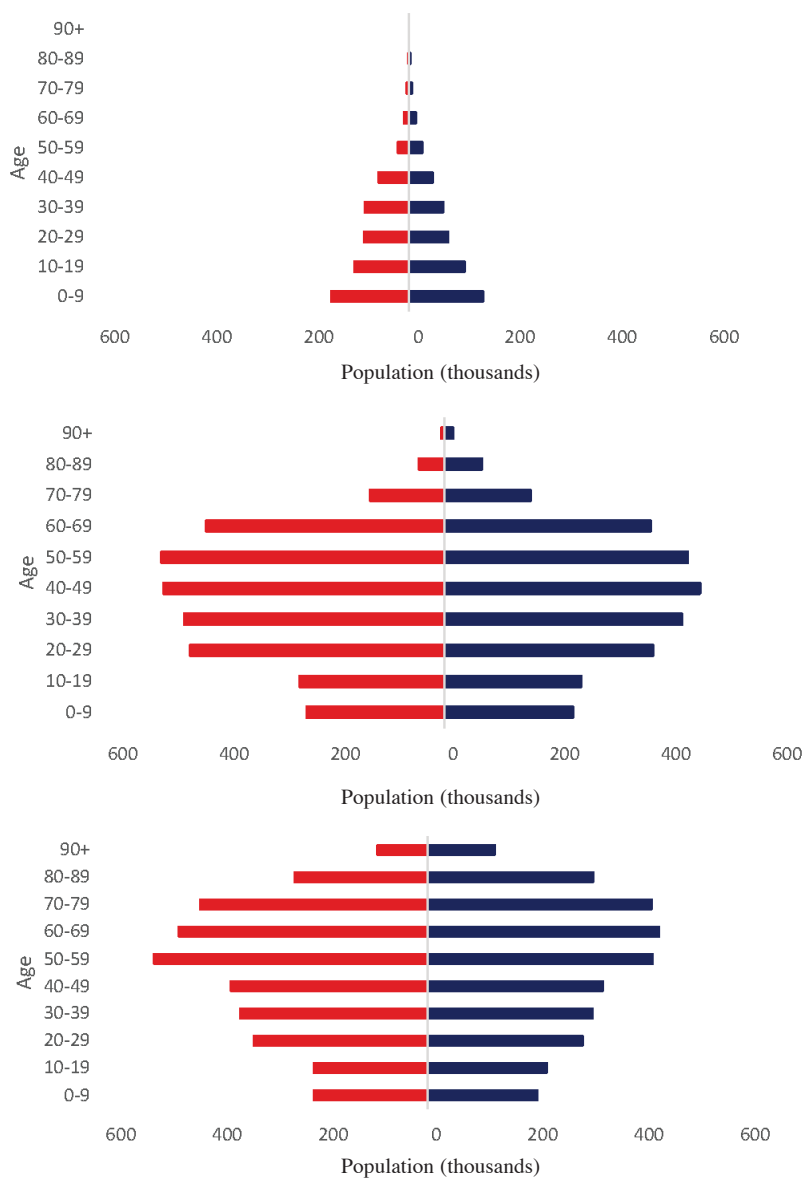
FIGURE 1-2 Singapore population pyramid: 1950, 2020, and 2050.
NOTE: Red = male population; dark blue = female population.
SOURCE: UN DESA, 2019a. This work is licensed under a Creative Commons Attribution 3.0 IGO License (https://creativecommons.org/licenses/by/3.0/igo).
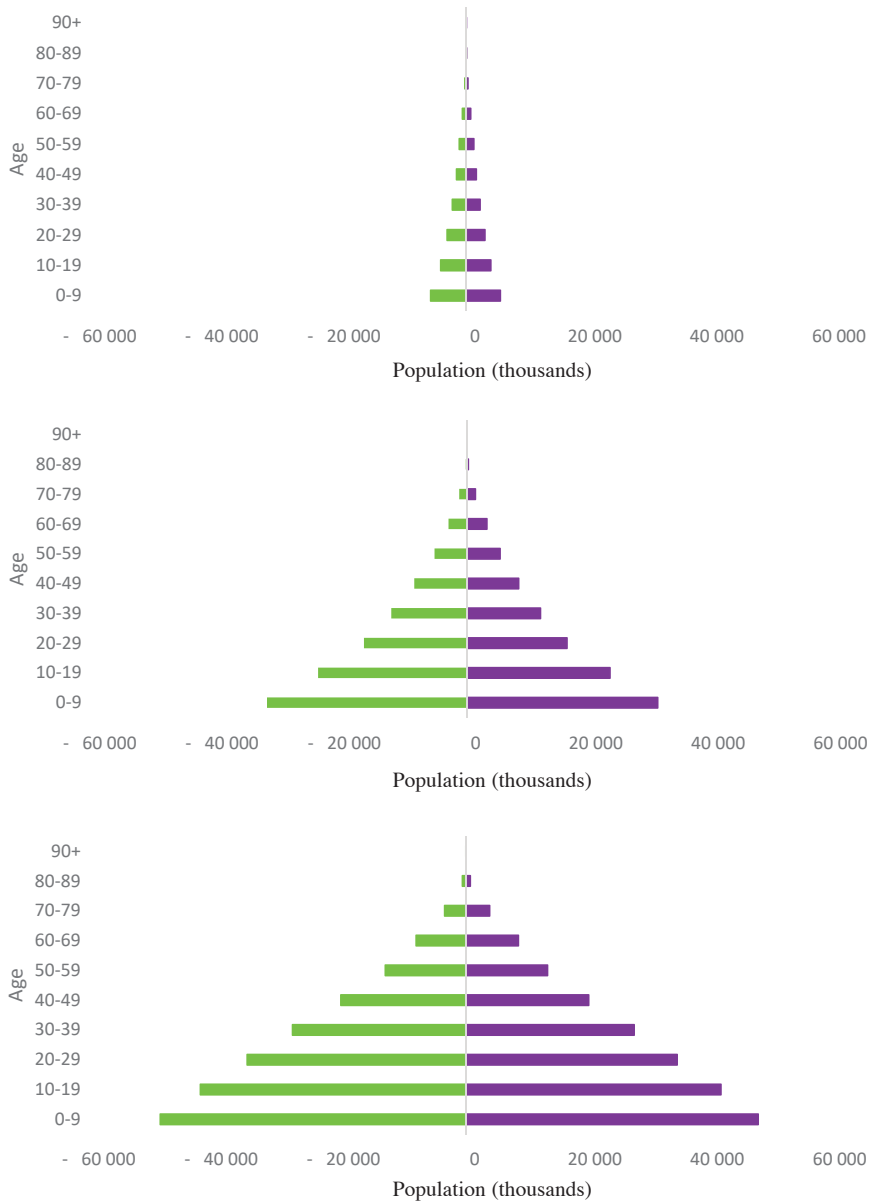
FIGURE 1-3 Nigeria population pyramid: 1950, 2020, and 2050.
NOTE: Green = male population; purple = female population.
SOURCE: UN DESA, 2019a. This work is licensed under a Creative Commons Attribution 3.0 IGO License (https://creativecommons.org/licenses/by/3.0/igo).

marriage patterns, educational attainment, urbanization, migration, and economic development are all influencing the lives of older people (UN DESA, 2021). Living alone or with a spouse and no other family members is widely valued in many high-income countries, but it is less often valued in low- and middle-income countries. In low- and middle-income countries, those not living within a larger family unit are likely to experience worse health outcomes, higher rates of poverty, and worse quality of life (Kamiya and Hertog, 2020). These changes in family structure and living arrangements also have important and potentially detrimental ramifications for intergenerational caregiving, financial security, and social connection. In Africa and Latin America, for example, older adults and grandparents are often the caregivers for children orphaned by HIV/AIDS (He et al., 2020; UN DESA, 2019b), and there is a disconnect between older adults' knowledge of modern medicine and basic pediatric health needs, such as vaccinations. Additionally, tension exists in some countries between older and younger people, the latter believing that older people receive a disproportionate share of jobs and government benefits (see Appendix C).

THE SCIENCE OF HEALTHY LONGEVITY

Heterogeneity of Aging and New Developments in Understanding Aging

Advances in healthy longevity are uneven among countries, among communities, and among individuals. According to the World Health Organization (WHO, 2021a), "The longer we live, the more different from each other we become, making diversity a hallmark of older age." Over time, individuals accrue biomedical and sociological advantages or disadvantages that lead to different life trajectories, resulting in substantial heterogeneity in the rate of aging. Thus, while disease, disability, and dependency increase with advancing age, especially after age 75, differential exposures across the life course to risk factors, such as social and economic factors, cause health outcomes of older people to differ markedly. Many older people have physical and cognitive impairments as well as chronic conditions, but an increasingly large proportion of older persons function at notably high levels into advanced ages. It will be important to observe changes to these trends caused by the COVID-19 pandemic. The emerging evidence of long-term effects on infected people points to raised rates of cognitive damage and damage to other body systems, which may impact the way people age (Schou et al., 2021).

Evidence on cognitive, emotional, and motivational aging indicates that societies can benefit from supporting positive aging trends. Recent evidence suggests that cognitive decline and a weakening of information processing speed and efficiency need not be a normal part of aging. Differences among birth cohorts are substantial, yielding significant individual differences in cognitive processing (Zelinski and Kennison, 2007). The prevalence of dementia is declining, partic-

ularly in high-income countries (Langa et al., 2017; Roehr et al., 2018; Walsh et al., 2022; Wolters et al., 2020), and evidence indicates that its prevalence can be predicted by education (Tucker-Drob, 2019). In contrast to cognitive processing, knowledge increases with age, especially in expert domains. Workers in knowledge-based jobs show no evidence of reduced performance, and those in "high-knowledge" jobs see performance gains with increased age (Baltes and Staudinger, 1993; Bangen et al., 2013; Grossmann et al., 2012). Evidence suggests further that emotional experience improves with age, as documented in countries around the world (Burr et al., 2020; Carstensen et al., 2011; Stone et al., 2010; Sun and Sauter, 2021). Finally, evidence indicates that as people age, they prioritize emotional meaning, giving greater priority to important social relationships, which in turn leads to greater prosociality, whereby older people are more likely to help others and give back to society.

Also worth noting are gender differences in the adaptation to aging societies. A study on all Organisation for Economic Co-operation and Development countries using the Aging Society Index compared the status of older men and older women. After accounting for the fact that women live longer than men, findings for all countries showed advantages for older men in productivity and engagement, financial security, and intergenerational cohesion. The results for well-being and equity were mixed but still generally favored men. These gender differences have many important implications for the development of policies and programs designed to foster equitable healthy longevity (Chen et al., 2021).

The Role of Biology in Healthy Longevity

The global increase in the life span can be credited in part to advances in science, one of humanity's greatest triumphs. In recent decades, researchers in geroscience,[3] nutrition, public health, and age-related chronic conditions have identified factors that, alone and in concert, have the potential to reduce disease and improve functioning and well-being to a degree not previously understood. As one example, sleep quality and quantity, which can contribute to a number of chronic conditions, such as Alzheimer's disease (Clark and Warren, 2013), are influenced by factors that can be manipulated, such as exposure to light and noise, as well as one's social environment (Muzet, 2007). Similar evidence exists for the potential of physical activity, nutrition, stress reduction, medication, and technology, especially in combination, to improve health and avert age-related

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[3] Gerontology, geroscience, and geriatric medicine are interrelated. "Gerontology is the study of the biological, psychological, and social aspects of aging" (Birren, 1996). Geroscience, a subset of gerontology, "is an interdisciplinary field that seeks to define the biological mechanisms of aging that give rise to numerous age-related diseases and disorders" (Kaeberlein, 2017). Geriatric medicine, which is grounded in gerontological and geroscience research, "is a subspecialty of internal medicine or family medicine that deals with the complex medical and psychosocial problems of older adults" (AAMC, 2021).

conditions. It is now understood that the rate of physiological aging is malleable and not an immutable part of life (Sierra, 2016).

Aging has been called the strongest risk factor for age-related conditions (Niccoli and Partridge, 2012). Many of the causes of early mortality in 1900—primarily infectious diseases—have been replaced by a series of chronic conditions linked to aging, including atherosclerosis (leading to heart attack and stroke), some forms of cancer, osteoarthritis, osteoporosis, type 2 diabetes, Alzheimer's disease, Parkinson's disease, sarcopenia, glaucoma, macular degeneration, and hearing loss (Barzilai et al., 2018; Verdin, 2021). The risk for the most common chronic conditions increases exponentially with age (St Sauver et al., 2015). Research is ongoing to understand the molecular links between the aging process and the development of disease in order to identify further ways of mitigating the risk factor of age. Shifting the target from studying specific diseases in isolation to studying aging therefore holds promise for changing the orientation of medicine from an organ-focused system that treats disease to a holistic, proactive, and ultimately preventive system focused on keeping people healthy.

Biological advances can unlock life's potential, dramatically changing the future of aging. Researchers are studying a multitude of biological pathways for slowing or even reversing the progression of aging. Some research has demonstrated the role of the environment in aging, such as the damaging effects of oxygen-rich environments on macromolecules and the effect of sunlight on joints and skin. Of particular importance, a series of genes has been identified that can exert control over the life span. Kenyon and colleagues (1993) discovered that the mutation of a single gene could induce a dramatic gain of function. Molecular biomarkers of aging may be a future avenue for evaluation of antiaging therapies in clinical trials. For example, shortened telomere length is associated with age-related conditions such as osteoporosis, cardiovascular disease, and Alzheimer's disease (Herrmann et al., 2018). Importantly, the characteristics of aging have shifted over historical time (e.g., incidence of dementia falling, cognitive performance increasing) (Langa et al., 2017). Other advances—such as human genome editing, partial reprogramming in which aging cells are reprogrammed into pluripotent stem cells, and regenerative medicine in which cell therapy targets senescent cells rather than a disease—also promise to shift the path of aging and disease. Researchers are working to understand the nature of these mechanisms and how they can be activated most effectively.

The Role of Data and Technology in Healthy Longevity

The use of technology to increase years lived in good health represents another shift away from medicine's traditional focus on treating disease. Technology for an aging society has undergone four waves, none of which has receded (Coughlin, 2021). The first wave resulted in assistive technologies designed to improve functionality. The second treated technology and aging as a "smart"

problem, with a focus on managing, monitoring, and motivating people's be-havior, such as through smart homes. In the current, third wave, the role of technology in aging is viewed as an economic opportunity for companies that can innovate products with the potential to incorporate vitality, functionality, activity, and fun and thus help create aging-friendly societies. In a parallel fourth wave, aging is seen as a problem of equity and inclusion that can be addressed in part by technology.

Digital technologies have the potential to improve healthy longevity at the individual and system levels. During the COVID-19 pandemic, purchases of smart speakers, tablets, and devices increased among older adults in many coun-tries, as did their use of internet-based platforms to communicate, receive health care services, arrange for grocery deliveries, and more. These increases in older people's uptake of technology illustrate the opportunity presented by the current digital era to implement transformative innovations to advance the creation of aging-friendly societies that meet the needs of older adults and allow them to participate actively in and enrich their communities. Digital technology also offers the potential to transform reactive health systems to make them proactive, predictive, and preventive (WHO, 2021b).

Technology presents opportunities to improve healthy longevity, but chal-lenges will need to be addressed. One key challenge is determining the endpoints for aging and the logistics of conducting clinical trials targeting aging processes. A second challenge is ensuring equitable access to and affordability of potential treatments and technologies. A third challenge is tackling inequities, such as those related to the digital divide, and addressing underlying social and digital determinants of health (WHO, 2021b). A final challenge is avoiding the misuse of data generated by smart technology and the need to ensure that personal data are used only for the intended purposes.

AGING MYTHS AND AGEISM

Steady declines in health, physical and cognitive function, and well-being associated with aging have long been viewed as an inevitable part of life (Sierra, 2016). Many people in the later stages of life experience prolonged periods of debilitating chronic conditions, functional decline, and diminished well-being (Diehl et al., 2020). These declines have long led to perceptions that older people as a group are inevitably dependent and a drain on society, despite the fact that many live without functional limitations (Achenbaum, 2021). In numerous coun-tries in North and South America, a majority of adults over age 65 live without serious physical or cognitive limitations, with many living independently in the community (Fausset et al., 2011; Houser et al., 2009; Rofman and Apella, 2020). Furthermore, aging brings on average more positive emotional well-being, emo-tional stability, and emotional complexity; an array of mature capabilities; and greater prosocial motivation (Carstensen et al., 2011).

BOX 1-1
Myths About Aging

Myth 1: "Old age begins at 65 years."
Myth 2: "A person's chronological age tells you a lot about him or her."
Myth 3: "Older people can't learn anything new."
Myth 4: "Older employees are less productive."
Myth 5: "Older people don't want to have anything to do with modern technology."
Myth 6: "Older people are taking jobs away from young people."
Myth 7: "Economies with an aging population are doomed to zero growth."
Myth 8: "Older employees have to be protected by special regulations."
Myth 9: "Higher average life expectancy means more sickness and more need for care."
Myth 10: "Prevention and rehabilitation are useless in old age."
Myth 11: "Aging reduces mobility."
Myth 12: "Older people are a burden to their relatives."
Myth 13: "A clash of generations is imminent."
Myth 14: "Our society has to adapt to demographic change by establishing policies for seniors."
Myth 15: "Aging societies are incapable of reform."

SOURCE: Backes-Gellner et al., 2010.

WHO defines ageism as "when age is used to categorize and divide people in ways that lead to harm, disadvantage and injustice and erode solidarity across generations" (WHO, 2021a, p. xv). Ageism affects people of all ages and is socially accepted in a way that other forms of prejudice are not. Nonetheless, because ageism leads to discrimination and unequal treatment, "ageism shortens lives; leads to poorer physical health and worse health behaviours; impedes recovery from disability; results in poorer mental health; exacerbates social isolation and loneliness; and reduces quality of life" (WHO, 2021a, p. 48).

The COVID-19 pandemic brought to the surface deep-seated ageism in some countries, such as the United States, manifesting in intergenerational resentment toward older people.[4] This resentment can be interpreted as reflecting younger people's views of older people as a drain on the economy and government finances (see Appendix B). Even within the health care system, chronological age was used to determine some people's access to a mechanical ventilator, despite arguments that use of chronological age to allocate scarce resources is not ethi-

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[4] Despite some resentment, young people across most countries made sacrifices—such as missing out on education, work, and social activities—to protect older people who were most likely to face serious harm or death if infected.

cally justifiable (Jecker and Pearlman, 1989; Joebges and Biller-Andorno, 2020; Montero-Odasso et al., 2020).

Ageism often manifests in the form of myths (see Box 1-1). While science has disproven many myths about aging that form the basis of age-based prejudice and stereotypes, the health care systems, socioeconomic structures, and policies designed around those myths have not changed. If ageism is overcome at the same time that health and function in older people improve, the inevitable shifts in population age structure and changing family structures can become drivers of a thriving society with the many positive characteristics described in this report.

REFRAMING THE CHALLENGE OF AGING SOCIETIES

Healthy longevity reframes the false assumptions that aging societies reduce workforce productivity and increase burdens on families and that older people disproportionately consume resources. A clear-eyed, evidence-informed view of the capabilities and vulnerabilities of older people points to the very real potential of aging societies to be, on balance, positive. It is important to recognize the substantial socioeconomic gradients that drive vast differences between advantaged and disadvantaged populations within and across countries. Together these observations suggest that long-lived populations are not an inherent problem for societies; rather, the problem for societies is the barriers that systematically prevent people from reaching their later years with the good health needed to thrive and contribute to family and society. To the extent that healthy longevity is accelerated on a global scale, a social resource can be developed that has never existed in human history—age-diverse societies that build on the complementarity of skills and qualities typical of both younger and older people. An evidence-based reframing of the potential of longevity suggests the need to move away from an exclusive focus on "coping with aging populations" toward removing existing barriers so the global community can age successfully and reap the economic and societal benefits of healthy older people. Accordingly, the focus of this report is on understanding how societies can create environments that provide support across the life course for people who need it while maximizing the contributions and capacities of individuals of older age.

THE COMPLEX SYSTEM OF GLOBAL HEALTHY LONGEVITY

Based on the evidence provided in this report, the commission argues that healthy longevity, or the lack thereof, is the result of the interactions of complex systems. To achieve the vision for healthy longevity described in the next chapter, multiple systems within society will need to be activated, transformed, and coordinated because healthy longevity is about all aspects of life. Advances in medicine have lengthened human life by preventing and treating diseases and developing

systems to better control for the multitude of factors that influence human health. As discussed throughout this report, however, a person's health is determined by social context, environment, and public health as experienced throughout life, in addition to biology and health care. Socioeconomic determinants of health, such as income security, education, and work, are critical drivers of healthy longevity.

While people are living longer, they are experiencing longer periods in poor health. No country or society has implemented a system that maximizes the potential of healthy older people and has achieved healthy longevity across the population. Too often, the systems influencing healthy longevity operate in isolation from one another. Diverse systems such as public health, income security, and a healthy environment are generally not connected by a goal of achieving healthy longevity for populations. A paradigm shift is needed to capitalize on opportunities lost when societies fail to maximize contributions from all people.

In making widespread change addressing all of these elements of a complex system, effort must be directed to reducing current and preventing further disparities between, within, and across countries. In many low-income countries, making breakthrough scientific advances in aging widely available to all citizens may not be achievable while also attending to, for example, gains in providing primary education. In middle- and high-income countries, trade-offs will also need to be considered in determining how best to achieve healthy longevity for all people. With more than half of the World Economic Forum's top 10 global risks in 2022 focused on environmental risks, resources are limited for making these broad systems changes (WEF, 2022). Nevertheless, the commission believes that the overall condition of a complex social, economic, and environmental system requires multipronged solutions to be devised and implemented by communities at the local level while being coordinated at the national and regional levels. By aligning efforts, activating all parts of society, and intentionally focusing on the interactions and relationships among these systems, the commission believes progress can be made toward developing healthier, longer lives for people around the world.

THE NATIONAL ACADEMY OF MEDICINE'S HEALTHY LONGEVITY GLOBAL GRAND CHALLENGE: CHARGE AND APPROACH

The National Academy of Medicine's (NAM's) Healthy Longevity Global Grand Challenge is a worldwide movement initiated in 2018 to improve physical, mental, and social well-being for people as they age. The aims of the initiative are to (1) comprehensively address the challenges and opportunities presented by global population aging; (2) catalyze breakthrough ideas and research that will extend the human health span; (3) generate transformative and scalable innovations worldwide; and (4) build a broad ecosystem of support by enabling

scientists, engineers, innovators, entrepreneurs, health leaders, policy makers, and the public to work together to achieve the promise of healthy longevity. Indeed, the commission approached the report with the goal of changing the perspectives of leaders across the public and private sectors to make an evidence-based case for achieving healthy longevity. Primary audiences for this report include leaders of health systems, employers, unions, nongovernmental organizations, faith institutions, and the news media. The report may also have applications for families and individuals seeking to learn more about the possibilities of healthy longevity and the opportunities to catalyze change in their communities.

In choosing to focus on healthy longevity, NAM recognized the convergence of multiple factors that have placed society on a precipice between an optimistic future of healthy longevity and avoidable disability and social challenges. These factors include the following:

- rising numbers of older adults globally compared with other age segments within the population, with rapidly rising numbers of older adults in many countries;
- rising rates of age-related chronic illnesses that, absent changes from the current trajectory, will increasingly burden individuals, families, and governments with rising health care costs;
- loss of human value, well-being, function, and dignity to disability caused by chronic illness, frailty, and cognitive decline;
- shifting family structures, dynamics, and norms within contexts of globalization, economic development, and crises and trends in urbanization and migration;
- a growing recognition that the current system of retirement, for those who are able to retire, is suboptimal for many individuals, organizations and institutions, and society as a whole;
- increasing social fraying, in some contexts, between younger and older generations;
- identification of social determinants of healthy longevity and the role of the built environment;
- evidence of the significant impacts of climate change and pollution on people across the life course; and
- a growing body of evidence demonstrating how to promote healthy longevity.

This report is the product of one of the two parts of the Grand Challenge. An international, independent, and multidisciplinary commission was charged with developing a comprehensive report assessing the challenges and opportunities presented by population aging and making evidence-based recommendations for how the challenges can be translated into opportunities for societies globally (see Box 1-2). The second part of the Grand Challenge is the Healthy Longevity

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BOX 1-2
Statement of Task

An international commission will be convened to assess the challenges presented by global aging and demonstrate how these challenges can be translated into opportunities for societies globally. The commission will assess the evidence across three domains: social, behavioral, and environmental enablers; health care systems and public health; and science and technology to develop an integrated and comprehensive approach to this task. With equity at its center, particular consideration will be given to policy and practice; innovation; financing; and monitoring and metrics.

The commission will produce a Global Roadmap for Healthy Longevity with actionable recommendations to guide a wide range of stakeholders in devising integrated, systems-based approaches for improving the health span and cultivating the health, productivity, and well-being of older populations.

1. Explore and recommend approaches to enhance social structures and living environments that strengthen socioeconomic and community support, and enrich the livelihoods of the elderly population. Special consideration will be given to social, economic, and demographic determinants (e.g., education, training, employment/volunteer status, nourishment, income, social connectedness, culture, diversity, ageism, self-perceptions of aging, discrimination, and health inequities); environmental determinants (e.g., physical and built environments, community systems); and lifestyle, resilience, and behavioral determinants.

2. Identify and analyze potential approaches and reforms across the entire spectrum of institutions and systems that provide health-related services to aging populations, including clinical settings providing health care and treatment; community and home health care, including family and informal caregivers; and public health systems, health promotion, and preventive services. Special consideration will be given to management of chronic diseases and multi-morbidities; nutrition; prevention across the life-course; social services; the eldercare workforce; workplace health; health insurance; and health care financing innovations.

3. Consider and put forward avenues for innovative and groundbreaking aging-related research and development—across basic, clinical, pharmaceutical, social and behavioral sciences, bioengineering, information technology, and assistive technologies—and recommend ways to expand research funding and incentivize research in aging. Special consideration will be given to elucidation of the cellular and biological mechanisms of aging and regeneration; advances in information technologies including the development of large databases, machine learning, and artificial intelligence tools that will inform approaches to therapeutic interventions but also enhance quality of life; emerging engineering technologies based on software and mechanical design; new business models for social innovation and social enterprises; and implications for investment in research and development, regulation, commercialization, and scalability, including issues pertaining to ethics and equality.

Global Competition. Through inducement prizes and awards, the initiative catalyzes transformative innovation and informs policies and priorities to advance healthy aging and longevity globally. The Global Competition is an ongoing separate activity from this report and is not discussed here in detail.

Where possible, the commission coordinated with other related global initiatives to achieve an integrated and synergistic effort. With equity as a central focus, the commission considered how evidence should inform policy and practice, innovation, financing, and monitoring metrics with respect to healthy longevity. The commission approached its work by collecting evidence across three domains: (1) social, behavioral, and environmental enablers; (2) health care systems and public health; and (3) science and technology. In three workshops, each dedicated to one of those three domains, the commission convened thought leaders from biological and behavioral sciences, medicine, health care, public health, engineering, technology, economics, and policy to identify the essential priorities and directions for improving health, productivity, and quality of life for older adults worldwide.

The commission also identified the need for consultations in two areas. First, it sought information about the state of aging from experts in global regions not adequately represented among the commission members, such as roles for older adults, filial piety, employment and retirement, and intergenerational cohesion, with an emphasis on low- and middle-income countries. Second, the commission sought information from experts in economics about how the economy and government spending affect healthy longevity and, conversely, how healthy longevity has the potential to affect the economy and government spending. Commissioners and NAM staff identified and invited experts to provide responses to targeted questions either in writing or during a brief discussion with staff (see Appendix C).

The commission used a "future-back vision" approach[5] to imagine a world in 2050 in which healthy longevity is a reality. This approach entails first an unrestrained imagining of what the future could look like based on the evidence, and then articulation of the steps needed to reach that vision. The future-back approach contrasts with the more common "present-forward" approach, whereby imagination is limited to evolution of the current state. Given that the society and systems of today were designed for lives much shorter than the current life span, the commission recognized the need for redesign to look across systems and reflect the vision of a future unconstrained by the status quo. Once imagined, the future-back vision is deconstructed to provide a roadmap of targets starting from the present and working toward the ideal future. Planning entails consid-

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[5] The future-back approach originated in the method of "backward-looking analysis," used in the energy field and described in Amory Lovins's *Foreign Affairs* article on energy strategy (Lovins, 1974). Subsequently, the approach was termed "backcasting" in several studies beginning in 1982 (Dreborg, 1996; Holmberg and Robert, 2011; Robinson, 1982). Backcasting, now synonymous with the future-back approach, has since expanded beyond the sustainability, energy, and urban planning fields to include such fields as economics; strategic business consulting; and, to a limited extent, health (WHO, 2020).

ering current limitations and barriers; identifying priority areas; and developing strategies, policies for implementation, and measures of success. By detailing the new future and specific targets for attaining it, including actionable goals, the approach ensures a continued focus on the end goal—the realized vision of a future of healthy longevity.

The commission met numerous times over the course of the study and collected and assessed research from a range of fields relevant to healthy longevity. This report also builds on and is consistent with previous reports of WHO, including *Decade of Healthy Ageing Baseline Report* (2021c); the United Nations, including *Political Declaration and Madrid International Plan of Action on Ageing* (2002); and the National Academies, such as *Social Isolation and Loneliness in Older Adults: Opportunities for the Health Care System* (2020), *Aging and Disability: Beyond Stereotypes to Inclusion: Proceedings of a Workshop* (2018), *Nutrition Across the Lifespan for Healthy Aging: Proceedings of a Workshop* (2017a), *Communities in Action: Pathways to Health Equity* (2017b), *Understanding Pathways to Successful Aging: How Social and Behavioral Factors Affect Health at Older Ages: Workshop in Brief* (2015), and *Retooling for an Aging America: Building the Health Care Workforce* (IOM, 2008), among others.

A HEALTHY LONGEVITY ROADMAP

Currently, the world is unprepared to address the challenges of rapid global aging and has not been able to translate this disruptive change into opportunity (He et al., 2016). Countries with the largest proportion of older people are experiencing many undesirable outcomes related to aging, including negative economic impacts, with increasing numbers of people leaving the workforce and rapidly rising health and social care costs, as well as increases in social isolation, loneliness, and suicide rates (Bloom et al., 2015; Holt-Lunstad et al., 2010; NASEM, 2020). Many of these negative outcomes will impact all countries, even those with a slower aging trajectory and younger populations. Specifically, the rise in chronic conditions, which develop about a decade earlier in low-income countries than high-income countries (see Chapter 6), will contribute to increased health and social care costs in all countries. If not addressed, avoidable or modifiable age-related decline that impairs health, function, and well-being will continue to burden older people and their families. Younger people may live with fear and trepidation with respect to their own aging. Societies will bear avoidable care costs, and humanity will lose the benefits that could have been realized from the contributions of older people with healthy longevity.

Demographic aging can be translated into a better world for all with thoughtful, strategic change. Science can provide direction for action that societies around the world can take to seize the opportunity to prepare for a future in which healthy longevity is realized for all people. This report is grounded in the belief that healthy longevity can initiate and perpetuate the virtuous cycle depicted in Figure 1-4. Healthy longevity enables health and productive engagement
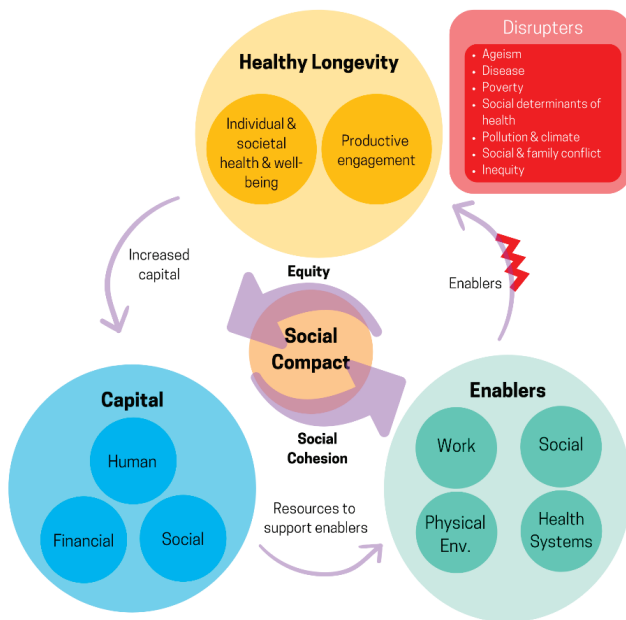
FIGURE 1-4 The virtuous cycle of healthy longevity.

throughout the life course; the benefits of healthy longevity build social, human, and economic capital; these expanded resources allow governments to ensure that healthy longevity is sustained by supporting enablers that stem from the health system, work, volunteering, socioeconomic conditions, and the physical environment; and the cycle repeats. At the center of this cycle is a new social compact driven by equity and social cohesion.

REPORT STRUCTURE

This report, the culmination of efforts summarized above, describes the significant untapped human potential of older people within society, as well as the benefits that would accrue to individuals and society if this potential were to be unleashed. It provides evidence-based recommendations for how countries can pursue an optimistic vision of healthy longevity for individuals and societies, a vision whereby prolonged periods of functional and cognitive decline as people age are no longer viewed as inevitable. This is also a vision of a cohesive, productive society that supports the aspirations of people in the first and second halves of life. Public- and private-sector organizations and institutions can use the findings, conclusions, and recommendations in this report to shape a future

of healthy longevity by 2050 that is appropriate to a variety of cultural norms, stages of development, maturity of care systems, and resources.

The commission emphasizes cross-cutting themes across all chapters of the report. These themes include equity and nondiscrimination, lessons learned from the COVID-19 pandemic, and science and technology as enablers of healthy longevity. The importance of a life-course approach to healthy longevity is a central recurring theme; it is impossible to separate healthy longevity in older adults from what has affected them in younger years.

Following this introduction, the report is organized into six chapters. Chapter 2 presents the commission's vision for healthy longevity in 2050. It describes an aspirational society in which healthy longevity has been achieved, based on the elements depicted in Figure 1-4. Chapter 3 describes the longevity dividend that would result from longer, healthier lives and the "capital"—human, financial, and social—that can result from healthy longevity, as seen in the bottom-left portion of Figure 1-4. Social enablers, physical environment enablers, and health systems—the enablers in the bottom-right portion of Figure 1-4—are discussed in Chapters 4 through 6, respectively. Finally, Chapter 7 presents the commission's roadmap for achieving its vision of healthy longevity.

This report is offered as a roadmap for all countries to begin a process of engagement and shared learning across all sectors and all actors in the global community as they develop plans and programs to ensure healthy longevity. The report necessarily relies heavily on evidence from and experience of high-income countries. The majority of the evidence on healthy longevity was developed within and for high-income countries. The experience of addressing rapid aging, to date, has happened primarily in high-income countries. The commission selected targets that, with few exceptions, are relevant to all countries.

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2

Vision for Healthy Longevity in 2050

The commission envisions a future of healthy longevity in which years of good health[1] approach the biological life span, with physical, cognitive, and social functioning that enables well-being. Healthy longevity is characterized by the preservation of health for all into older ages. Accomplishing this vision demands a lifetime of learning and growth, diverse and intergenerational relationships, productive and rewarding work, and societal roles that enable people to live with a sense of meaning, purpose, and related opportunities at every stage of life. In a world of healthy longevity, age does not prevent people from holding valued positions in communities and societies or from benefiting from the complementarity of strengths across age groups.

In this chapter, the commission offers a vision for the world in 2050 in which healthy longevity is achieved and systems are in place that enable all people to realize their potential. This vision of a possible future is grounded in evidence presented in the following chapters, which describe current barriers to and systems that enable healthy longevity. Vision 2050 helped the commission identify the transformations needed to create healthy longevity.

VISION 2050

Scientific and experiential evidence accrued over the past 50 years supports an inspiring vision for what societies can be in 2050, with countries around the world having culturally appropriate, thriving societies of people living healthier,

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[1] Health in this report is defined as the "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1946).

41

longer lives. Building on the reality of a rapidly aging world, this vision can power a transformation whereby individuals and societies flourish as a result of enhanced health and social capital, as described in the sections below.

Vision 2050 builds on the investments and efforts made toward achieving the United Nations (UN) Sustainable Development Goals (SDGs) for 2030.[2] While all 17 SDGs are synergistic with healthy longevity, a few goals are particularly pertinent to healthy longevity. In particular, Vision 2050 emphasizes good health and well-being (SDG 3), quality education (SDG 4), and decent work and economic growth (SDG 8). Vision 2050 is designed to allow societies to benefit from the assets of maturity and to meet generative goals and improve health. In this future world, societies will experience many more years in good health and leverage the collective efficacy of the potential social and human capital of older adults and the intergenerational synergies of old and young to meet both major unmet societal needs and the goals of older adults. Societies can thereby build the future for succeeding generations and realize increased well-being for people of all ages.

This vision of thriving aging societies is purposefully aspirational, as well as based in evidence. Many older people will lack the health and abilities to engage in all of the ways described. However, the commission asserts that all people deserve the opportunities and the agency to decide how to use their time, have basic protections that ensure their well-being, and receive care to achieve the best health they can attain.

A Vision for Individual Healthy Longevity

Imagine a world in 2050 in which the science supporting healthy longevity has been incorporated into everyday life. In this future, all people enjoy overall well-being, decreased disease burden, effectively controlled diseases and conditions, maximized intrinsic capacity and function, and years of good health that approximate the lengthened life span. At the individual level, experiences are shifted such that the life course is not segmented into distinct stages of life experiences (e.g., early childhood, education, work, retirement). Rather, education is lifelong, work careers are fluid, and people have time to do what they find meaningful. People at all stages of life have equal access to health, education, good jobs with a living wage, opportunities to contribute to their family's and community's well-being, and the ability to live their lives with meaning, purpose,

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[2] The 17 UN SDGs are as follows: GOAL 1: No Poverty; GOAL 2: Zero Hunger; GOAL 3: Good Health and Well-Being; GOAL 4: Quality Education; GOAL 5: Gender Equality; GOAL 6: Clean Water and Sanitation; GOAL 7: Affordable and Clean Energy; GOAL 8: Decent Work and Economic Growth; GOAL 9: Industry, Innovation, and Infrastructure; GOAL 10: Reduced Inequalities; GOAL 11: Sustainable Cities and Communities; GOAL 12: Responsible Consumption and Production; GOAL 13: Climate Action; GOAL 14: Life Below Water; GOAL 15: Life on Land; GOAL 16: Peace, Justice, and Strong Institutions; GOAL 17: Partnerships for the Goals (UN, 2021).

and dignity. Synergies across generations are woven into society, and people engage with others and contribute to societal well-being in ways that previous generations may not have imagined.

In Vision 2050, people in the first half of their lives acquire skills and experiences, take risks appropriate to their life stage, and create positive life paths. Young adults have more employment opportunities than they do today, because more people are working longer in the workforce and due to new economies born from the aging of society spur innovation, businesses, and jobs.

Older people live a previously unimagined range of paths aligned with human and societal development and well-being. Because employers recognize their capabilities and value the experience they bring to organizations, older adults have more opportunities to work for pay, and many choose to do so. In a world of healthier, longer lives, people contribute to societies by remaining in the workforce longer, volunteering, or engaging in caregiving or other roles. Individuals are retrained as needed, with greater flexibility in how retraining can be done. Employees experience heightened satisfaction and cohesion and contribute increased innovation and productivity at the workplace as a result of better health and workplaces that accommodate their needs and foster intergenerational teams. Importantly, workplace accidents and occupational disabilities are also reduced. At older ages, people are connected through advances in both technology and transportation, and have time to engage in personally meaningful and societally beneficial activities (e.g., supporting younger generations, preserving the environment), free from policy, cultural, or other barriers. For those who are sick or have impaired function, care is provided in a manner and location that are personalized and supportive of their goals.

In a world of healthy longevity, people are active partners in and managers of their own health care. They engage in prevention throughout their lives, supported by modernized public health that creates conditions that promote health and make healthy choices possible. Care, including long-term care, is culturally appropriate and accessible when needed. Even with impaired functioning, people enjoy lives of autonomy, meaning, and dignity. Affordable options for receiving care are available, and family caregivers receive training and support, including financial support when possible.

Advances in science and technology enable the identification of those at increased risk of disease, allowing for prevention or early detection so that preventive and therapeutic options can be maximally effective. Enabling technologies within communities allow people to integrate health and well-being into everyday life, with health facilities being not in one physical location but available everywhere via mobile-enabled platforms.

In 2050, societies value the capabilities and assets of older adults for what they do for others, not just what they contribute to economic growth. Equitable opportunities exist for them to experience a full range of engagement, both in paid work and in civic and other roles and relationships with others within and

across generations. Younger and older people benefit from intergenerational collaboration, mentorship, and valued roles. And with increased connection and satisfaction from these intergenerational relationships, loneliness is an exception, not a default part of aging.

A Vision for Societies of Healthy Longevity

Imagine a world in 2050 in which the health of older adults is recognized as an asset for nations and societies. Older adults bring transformative potential for intergenerational well-being and productive engagement, underpinned by unique assets associated with aging. With a rebalancing of resources and investments in social determinants of health, healthy longevity enables vibrant and healthy later life, with opportunities for meaningful roles and responsibilities. After decades of focus on equity, families, communities, and societies are flourishing. The economic well-being of nations is bolstered by the success of young adults, often fostered by the mentorship and partnership of older adults, which results in intergenerational cohesion. Societies have made sustainable investments and built institutions to create a state of well-being across the full and extended life course. In this aspirational future, societies prosper as a result of a virtuous cycle whereby young and old work together to solve challenges. An expanded workforce drives thriving economies, greater investment in public goods using resources freed from national health care budgets, stronger communities, and families benefiting from grandparents and great grandparents nurturing grandchildren.

Healthy longevity relies on a life-course approach to addressing and investing in health and functional, psychological, and social needs from the beginning to the end of life. Health systems work together to prevent, slow the progression of, and manage chronic conditions, enabling older people to be active and engaged members of society. In 2050, societies have a global public health enterprise, characterized by globally unified collective action to protect health for all people from, for example, risk factors for chronic diseases, frequent novel infectious agents that cause pandemics, and climate change. The resolution of health disparities, creation of strong public health systems, development of life-long quality education, and social protections enable all people to live long lives with health and function. Personalized health services, including long-term care, are available to all who need them. Care for older adults is provided by health professionals knowledgeable in geriatrics, and countries adopt care delivery models that support accessible, affordable, quality care. Precision public health systems use big data and advanced analytics for surveillance and development of interventions to prevent infectious diseases and chronic conditions. All countries have significantly reduced the costs of medical care through better prevention and earlier optimal intervention that averts complications or the need for more resource-intensive therapy.

All people benefit from the combined investments in essential social protections. For example, people benefit from enhanced education systems across the life course, inclusive of higher education, which is a predictor of health, cognition, function, and social engagement. Older adults are financially secure, and financial supports are available at a level that supports, at least, people's basic survival. Economic returns on these investments are reaped into the oldest ages, such that people experience longer lives with the benefits of healthy longevity and the ability to spend their later years in pursuits they value. Thanks to greater inclusion of older adults in the user-centered design process, more digital technologies and tools are used by people of all ages.

Businesses recognize the evidence that older adults are valuable workers and that the decline in the younger workforce due to shrinking population sizes can be offset by the contributions of older workers. Accordingly, they redesign the workplace to be less physically taxing and offer more flexible schedules, which benefit workers of all ages. Intergenerational teams are established as the norm for business processes based on the evidence for beneficial outcomes from this approach. Investments in designing appropriate training and retraining enable career development for people of all ages, allowing older people to remain in the workforce longer. Fears that older workers will take jobs from the young have dissipated with the realization that larger workforces strengthen economies and increase opportunities for younger workers. Older workers have become key employees. The concept of "retirement age" has been eliminated, and people can elect to work for as long as they want or need.

In the year 2050, critical connections made between health and the physical environment endure. Urban planning and design are equitably implemented in housing options and cities, using principles of universal design and supporting social cohesion at the community level. People living in lower-socioeconomic regions or neighborhoods have the same ability to commute and travel as those living in upper-income areas. An explosion of the most up-to-date interfaces with the internet in public and private places allows younger and older people to connect with one another and use the wealth of digital information and resources. While climate change remains an ongoing concern across the globe, mitigation and monitoring efforts are ongoing. When disasters do occur, older adults are targeted for early evacuation or provided with provisions to stay safe.

In 2050, societies recognize that older age is the "pay-it-forward" stage of life, as older adults display great concern for others and prioritize emotionally and humanly meaningful goals and a desire to "give back" for future generations. Leveraging these assets of older people, coupled with their lifetimes of experience and desire to leave future generations better off, the world has unleashed the potential of the unprecedented large numbers of older people by fostering high-impact roles for them at scale. People of all ages contribute regularly to the community to solve shared concerns, intentionally drawing on the capabilities and

assets of each age group to bring people together across generations to learn from one another and create solutions. Civic participation strengthens appreciation of interdependence and successful communities. Governments recognize and invest in efforts to coalesce their citizens around a set of prosocial values and roles that support a transformed society. Countries recognize the effects that demographic forces and ageism have had on segregating generations. Intentional approaches to resolving disparities, improving cohesion, and valuing the contributions of each age group are deployed. New norms for engagement by older adults have been amplified through the development of roles that use their capabilities, metrics that value the in-kind contributions of older people, and evidence-based policies that recognize the importance of both in-kind contributions and paid work by older adults for societal well-being.

The glue that holds societies together is the social compact. This often implicit agreement among members of a society delineates what they expect from one another and from governing bodies. The social compact is codified in a society's institutions, regulations, and laws, and embodied in its culture. In 2050, social compacts around the world are grounded in the promise of thriving aging societies. The social norms for societies and their cultures prioritize helping all people attain basic living needs through health promotion and provision of care, lifelong learning opportunities, and protection against financial vulnerability. As depicted in Figure 1-4 in Chapter 1, the social compact is at the center of the virtuous cycle for healthy longevity. By being based on social cohesion and equity, a new social compact can fuel healthy longevity.

Principles and Goals for Healthy Longevity: Developing Systems to Realize the Potential of All People

The population shifts described in Chapter 1 necessitate both investments in healthy long lives for all and new norms and programs to foster the full social engagement of mid- to older-age adults. Healthy longevity in fact requires a life-course perspective and necessarily impacts people of all ages—particularly the youngest and oldest members of society. If recognized through a life-course approach, the value of healthy longevity could motivate action. As described throughout this report, however, the current systems supporting societies around the world were generally not developed for healthier, longer lives. Therefore, health systems, education, social protections, and work and economies will need to be re-envisioned and adapted to support and realize the potential of healthy longevity. Innovation in any one sector will not be sufficient to lead to a transformation. Transformation of all sectors will be needed and can be achieved by viewing healthy longevity as a complex system wherein these seemingly independent systems interact, build on each other, and create supporting networks toward a common goal (Bar-Yam, 1997; Miller and Page, 2007). By involving all sectors

of society through a complex systems approach, the commission believes that its vision for a world of healthy longevity can be achieved by 2050.

Achieving this vision will require intentional and sustained commitment and dedicated resources. However, the commission believes the return on investment will be substantial. Importantly, any such transformation will have to be designed to account for the heterogeneity of (1) people—from those who are robust to those who are frail, disabled, or living with cognitive decline; (2) cultures and contexts; and (3) political realities. In transforming systems, societies will need to weigh many trade-offs and consider how to prioritize investments. These considerations and resulting decisions will differ widely among countries, particularly low- and middle-income countries, as every country has different priorities and needs. The commission believes that by solving the challenge of healthy longevity across relevant domains, societies can generate more value for less overall investment in the long term.

Recognizing the varying approaches that will be taken by countries around the world, the commission has formulated a set of goals that, if achieved, will result in systems changes across societies to achieve healthy longevity, enabling people of all ages to live life with meaning, purpose, and dignity underpinned by improved health (see Box 2-1). Collectively, these goals can guide the requisite transformation of systems and form the backbone of the commission's roadmap for global healthy longevity. To enact a future of healthy longevity, countries will need to be cognizant of local factors and carefully balance resources with the requisite benefits. Central to achieving these goals are a strong social compact, good and effective governance, and investments in science and technology. Through evaluation and future research, societies can measure the impacts of their efforts on the health of their populations.

BOX 2-1
Principles and Goals for Achieving Healthy Longevity

Overarching Principles for Healthy Longevity

1. People of all ages, particularly older adults, reach their full potential to live life with good health, functioning, meaning, purpose, and dignity.
2. Societies enable the best health and functioning that individuals at all ages are capable of attaining.
3. Societies reduce disparities and enhance equity within and among countries to realize the well-being and contributions of all people, including those of older ages.
4. The human, financial, and social capital of older people is realized for the benefit of all of society.
5. Societies use data and meaningful metrics to track the achievement of outcomes and guide decision making.

BOX 2-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050

1. Economic and social benefits generated by people living, working, volunteering, and engaging longer.
2. Social infrastructure, institutions, and business systems that enable safe and meaningful work and other community engagement at every stage of life.
3. Education and training opportunities that promote participation in lifelong learning and growth.
4. Social cohesion augmented by intergenerational connections and the creation of opportunities for purposeful engagement by older people at the family, community, and societal levels.
5. Social protections and financial security that mitigate the effects of financial vulnerability at older ages.
6. Physical environments and infrastructure that support functioning and engagement for people at older ages.
7. Integrated public health, social service, person-centered health care, and long-term care systems designed to extend years of good health and support the diverse health needs of older people.
8. Quality long-term care systems to ensure that people receive the care they require in the setting they desire for a life of meaning and dignity.

Many of the goals in the commission's vision for 2050 align with the UN SDGs. The commission believes that by realigning resources and building on efforts to achieve the UN SDGs, countries can achieve these goals for healthy longevity. At the same time, the pursuit of healthy longevity will support achievement of the UN SDGs.

CONCLUSION

In 2050, the commission envisions a world in which older adults, with good health and function, engage in relationships, their communities, families, and the economy such that extraordinary amounts of social and human capital are enabled by the collective impact of this engagement. Overall, if governments, the private sector, and individuals make the requisite investments, the unique social and human capital that older adults bring to society could result in uniquely possible win-win-wins: for older adults, direct beneficiaries, and societal thriving writ large.

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3

A Longevity Dividend

The benefits of healthy longevity are many. This chapter describes economic and fiscal benefits that societies can expect as they improve the health and well-being of people across the life course. Figure 3-1 describes components of the commission's roadmap and timeline for achieving the economic and fiscal benefits of healthy longevity. The commission asserts that the longevity dividend is possible only with action across the domains discussed in this chapter in concert with those discussed in Chapters 4, 5, and 6.

INTRODUCTION

Improvements in health over the life course and fewer years spent in poor health are intrinsically valuable to people. Beyond intrinsic value, good health adds value to the economy and government coffers. When accompanied by life span increases, good health also enables people to work longer to finance their longer lives. But societies must change "how we think, act, and feel about older people and aging" (Ghebreyesus, 2021, p. 865) to reap a new and expanded longevity dividend. The anticipated longevity dividend for individuals includes an expanded period of life with good health and well-being that allows them to be productive members of society in paid and unpaid roles. With this better health and long life, most people will work longer than they do now to support the cost of their healthy, long life. The individual dividend feeds into a societal dividend with intangible benefits from social cohesion and a thriving population of old and young people, in addition to a larger economy, as measured by gross domestic product (GDP), which feeds government coffers. A large literature in

51

Longevity Dividend Key Targets

Work and retirement, volunteering, and lifelong education and retraining

2022 - 2027

Recommendations for Next 5 Years

(full text at end of relevant section within Chapter 3)

3-1. Design work environments and develop new policies that enable and encourage older adults to remain in the workforce

3-2. Prioritize investments to redesign education systems to support lifelong learning and training; invest in the science of learning and training for middle-aged and older adults

2022 - 2050

Examples of Supporting Structures

- Increased older-adult participation in the paid workforce and volunteer roles to maintain individual and societal economic equilibrium with population aging
- Incentives to recruit and retain older workers to increase workforce participation, emphasizing the worker's preferences, strengths, and capabilities
- Policies and incentives to keep older people working and remove barriers to remaining in or rejoining the workforce
- Formal programs to provide volunteers with meaning and purpose through opportunities to benefit communities and the next generation
- Development and adoption of a range of innovative and age-appropriate pedagogical approaches that work for people of all ages
- Expanded access to secondary education, vocational training, and higher education to train and upskill workers of all ages

2050

Goals

1. Economic and social benefits generated by people living, working, volunteering, and engaging longer
2. Social infrastructure, institutions, and business systems that enable safe and meaningful work and other community engagement at every stage of life
3. Education and training opportunities that promote participation in lifelong learning and growth

FIGURE 3-1 Longevity dividend roadmap.

economics supports the notion that health, including health for older people, is good for economic growth.

While longevity has been increasing globally, recent gains in longevity have come with more years in poor health (see Chapter 6). If this trend continues, societies may struggle to support the health care, long-term care, housing, pension, and other needs of older people. Fortunately, as discussed in Chapters 4–6, much is known about how to increase healthy longevity. With an increase in years in good health as a proportion of the life span, older people will spend more of their

years with the health they need to remain active and to engage and participate in and contribute to society in the ways they choose.

The commission envisions that older people in middle- and high-income countries may seek to remain in or re-enter the workforce, care for or support family members, volunteer, or engage in other activities for the good of society. The aim of this report is to provide a roadmap for removing barriers to and expanding options for productive engagement for everyone in all countries, especially older people.

This chapter addresses work and retirement as either/or states, but there are many paths in retirement. People move in and out of the workforce in early and middle ages (e.g., for childrearing) and as they grow older. Some have called for "an end to retirement," not in terms of pensions or financial support but an end to the expectation that people should start work after receiving education, work for a long period, and then stop working altogether. Instead, as people need to work more years to support their longer lives, they will likely experience cycles of work, retraining, absence from the workforce, and reentry into the workforce across the life course. This view of life is described in several recent publications, including *The New Map of Life* (Stanford Center on Longevity, 2021) and *The 100-Year Life* (Gratton and Scott, 2016). Although a future of healthy longevity will require attention to work and education across the life course, this chapter focuses on the later work years.

In contrast to most key targets across this report, the key target focused on work and retirement in this chapter is less relevant to low-income countries than to high-income countries. Specifically, the commission does not suggest that low-income countries could improve healthy longevity by increasing the number of older people working because a much higher percentage of people over age 65 remain in the workforce in these countries (see Figure 3-4). Rather, in Chapter 4, the commission recognizes the importance of expanding access to pensions for low-income older people across countries, which could enable a period without work in later years, potentially decreasing the percentage of older people in the workforce in low-income countries.

Demographic Change and the Economics of Healthy Longevity

To understand how to harness the economic benefits of healthy longevity, it is necessary to disentangle two forces: falling birth rates and the rise in longevity. Both are demographic transitions leading to a shift in the age structure of the world's population.[1] In combination, they are increasing the number and proportion of older people. To reap the economic benefits of this shift, a society

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[1] A third factor that has the potential to mitigate workforce challenges in rapidly aging countries is international migration (Peri, 2020), but that subject is beyond the scope of this report.

"focuses on changes in how people age and the exploitation of life-expectancy gains" (Scott et al., 2021, p. e820). Globally, aging is occurring in every country around the world, and while life expectancy is highest in the wealthiest nations, it is rising most rapidly in low- and middle-income countries. While many low-income countries currently have a large younger population, this large young cohort can be expected to become a large old cohort. Therefore, an aging society is a reality for countries across all income levels.

Countries that have seen large and rapid declines in their fertility rate (e.g., Japan, China, Singapore, Vietnam, Thailand) are witnessing a very dramatic change in their age structure. There is fear that lower-income countries that are aging rapidly may get "old before they are rich" (Heller, 2006, p. 7), meaning that they face rapid aging but do not have the well-developed social institutions needed to support older populations, including pensions, health care, and long-term care. Countries such as the United States, which have seen a more gradual decline in their fertility rate and high levels of immigration, are experiencing an aging society but at a slower rate relative to many other countries. Even in low-income countries with slow growth in the older population, the number and percentage of older people will still grow.

Measures of the Economic and Fiscal Impact of an Aging Society

The standard narrative about aging societies in both popular culture and the academic literature assumes that a rapidly aging population leads to economic decline. More older people are assumed to create a smaller labor force, larger pension and health care costs, and therefore declining rates of GDP growth and rising public debts (Aksoy et al., 2019). The "old age dependency ratio" is the percentage of the population aged 65 and over divided by the percentage of the population between ages 15 and 64. This ratio is an easy-to-use but imperfect measure of the relationship between age structure and the economy. It assumes that "old age" and "dependency" begin at age 65, a view that has been undermined by the contributions of people aged 65 and older discussed below.

The old age dependency ratio and the assumptions it drives about the economic futures of rapidly aging countries have been criticized for more than a decade, but it is still used as a main piece of evidence that population aging is an alarming and negative phenomena. Yet, using chronological age to define "old age" ignores the heterogeneity of health and life expectancy among older people (see Chapters 1 and 6) and how, over time, health status at a given age has changed and how longer lives also offer new opportunities to shift behavior. In response, alternative approaches to a simple chronological age-based dependency ratio have been developed and studied. Some consider the ratio of pensioners to total employment (Bongaarts, 2004) or the ratio of non-workers to workers (Vaupel and Loichinger, 2006). Alternatively, some have focused on prospective age based on remaining life expectancy rather than years since birth. Lutz and colleagues

(2008) proposed measuring old age as the time when remaining life expectancy is 15 years or less. Later, Sanderson and Scherbov (2013, p. 676) suggested using a "characteristics approach" to prospective age that includes "life expectancy, mortality rate, and the proportion of adult person-years lived after a particular age." Researchers who applied the prospective aging concept to populations in Central and South America found that there was not a "massive aging process" under way. Rather, the global region is not rising at the potentially catastrophic rates that the old age dependency ratio suggests (Gietel-Basten et al., 2020).

Return on Investment of Good Health

Good health has both economic and intangible value. Economists have the tools needed to calculate the value of health, and when governments determine how to prioritize spending, they often use these tools to assign value to intangible benefits, such as well-being, separate from impacts on finances or GDP. Given the importance of health, economists have developed models for assigning dollar values to the outcomes from various health treatments (e.g., chemotherapy for cancer) to inform policy makers in resource allocation. Economists most commonly use these tools to evaluate treatments for specific diseases, but they can also be used to identify the value of healthy longevity.

People generally value longer life and improvements in the quality of life associated with good health. In valuing health and longevity, the value of longer life and improved quality of life can be quantified from the perspective of value to the person (Murphy and Topel, 2006). In contrast, traditional GDP-focused economic measures underestimate the value of longevity, health, and well-being because they do not account for improvements in length or quality of life. Valuation is critical to making informed policy and financial decisions because the public sector has borne much of the cost of the health care and medical research that have been responsible for increased life span and improved quality of life.

Various researchers have estimated the value of health. Murphy and Topel (2006) estimated the value of health improvements, independent of longevity, in the United States between 1970 and 2000. They estimated that the value of health improvement to men and women in their 40s was highest at roughly USD1.2 million and USD820,000, respectively, on a per capita basis.

Adding another dimension, Scott and colleagues (2021) found that the number of years in good health has remained constant as life expectancy has risen, creating a longer period of unhealthy life. They used the value of statistical life model to calculate the monetary value of the economic gains from slowing the rate of aging and achieving longer and healthier lives based on people's willingness to pay for good health. Their results show that, while increased life expectancy is valuable, the highest value to the individual is achieved when healthy life expectancy increases to match life expectancy. The authors assert that, given current life expectancy and disease burden, slowing down aging and reducing the

advent of clusters of chronic, age-related disease is currently the most important policy imperative. They estimate that delaying the onset of age-related chronic disease to achieve one more year of life expectancy and associated improvements in good health is worth USD37 trillion in present value terms for the United States alone. Furthermore, they show that the gains due to healthy longevity will increase as the population comprises a greater number of older people living longer (Scott et al., 2021).

IMPACT OF WORK AND RETIREMENT ON HEALTHY LONGEVITY

Across the life course, the quality of jobs influences healthy longevity. The commission emphasizes the need for good, safe jobs in Recommendation 3-1 (presented later in this chapter). The impacts of work and retirement on physical, cognitive, and mental health can influence whether people choose to stay in the workforce. Those impacts are heterogeneous and are influenced by lifetime earnings, education, and other factors. Painting a clear picture of the costs and benefits of work and retirement is challenging because methods used and populations studied are heterogeneous. And, as shown below, context can shift the balance between work that improves and work that worsens health.

Working Versus Not Working

Many studies show positive correlations between work and health. For example, in a U.S. study of people aged 59–69, employed participants were found to be 6 percent less likely than those who were not working to report fair or poor health, and there was a small, but statistically significant, positive impact on activities of daily living (ADLs), independent activities of daily living (IADLs), mood, and mortality. People with demanding, undesirable jobs still benefited from better capacity to carry out ADLs and IADLs but were worse off with respect to mood and mortality (Calvo, 2006). A Japan-based longitudinal study of depressive symptoms in people aged 55–64 found that men had fewer depressive symptoms when they engaged in more hours of paid work or volunteering. They also had more depressive symptoms when they lost their job, but volunteering mitigated the effects of job loss. Women who engage in multiple productive roles, not housework alone, may experience less depression (Sugihara et al., 2008). A systematic review found an absence of negative impacts from working beyond retirement age, and 4 of 10 articles in the study showed statistically significant positive effects on mental health outcomes. The researchers hypothesized that the mechanisms for improvements include "productive societal roles, income, and social support" (Maimaris et al., 2010, p. 532). They emphasize that the benefits are not universal and should not be used to justify an increase in the retirement age (Maimaris et al., 2010).

A more recent review article evaluates 19 studies—12 on the impacts of an increase in retirement age and 7 on working beyond retirement age. The review found that increased retirement age increased labor force participation[2] among older workers and shifted their preferred and expected retirement age higher. But the findings on health and well-being were not comparable, and the authors therefore conclude that the evidence for a beneficial impact of increased retirement age on older workers' health and well-being is "scarce and inconclusive" (Pilipiec et al., 2021, p. 298).

A wide-ranging systematic literature review highlights the nuances in the relationships between work and health:

- Characteristics of and changes to work-task patterns over time determine whether work makes people more or less healthy. For example, physically and/or mentally exhausting work makes people less healthy unless work tasks change over time.
- Variety in work tasks can decrease age-related cognitive decline.
- Characteristics of the job and time spent doing the same job can lead to loss of productivity and motivation.

The researchers found "tentative evidence that underscores the importance to implement moderate novelty in work tasks in order to keep the brain active and to counteract age-related decline in functioning" (Staudinger et al., 2016, p. S287).

Relationships Between Retirement and Healthy Longevity

Another way to look at the impacts of work on older workers is to consider the effects of retirement. Like the literature on the impacts of work on health, this literature shows that retirement's impacts are heterogeneous. Many studies suggest that retirement has negative effects on health, although studies do not always control for selection bias. People with poor health are more likely to retire than are people with good health, and a study that fails to control for this effect

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[2] Defined as follows: "The employed include people aged 15 and over who, during the reference week worked for one hour or more for pay, profit, commission or payment in kind, in a job or business or on a farm (comprising employees, employers and own account workers); or who worked for one hour or more without pay in a family business or on a family farm (i.e., contributing family workers); or who had a job, business or farm, but were not at work for various reasons (holiday, sickness, strike, etc.). In brief, employment is of a dichotomous nature and covers people working a few hours per week, as well as those working a very large number of hours per week and cumulating several jobs. The employed can also be people engaged only in production of goods for own final use (subsistence work). Subsistence work can be extremely important in poor agrarian areas. It is important to note that work in unpaid household services is not counted as employment, largely explaining differences in labor-force participation rates by gender" (Staudinger et al., 2016, p. S282).

will suggest that retirees are less healthy than people who continue to work. A leading U.S.-based longitudinal analysis of Health and Retirement Study data suggests that retirement can lead to decline. Even after controlling for confounding variables, the evaluation showed that, in the 6 years after retirement, retirees experienced increases in mobility challenges and ADLs (5–16 percent), chronic condition (5–6 percent), and a decline in mental health (6–9 percent) (Dave et al., 2006). Another study found that negative effects of retirement on cognitive performance were more prominent among physical workers than among knowledge workers, with those of the lowest socioeconomic status showing the greatest loss in performance. Variation was seen among the different types of workers studied in the effects of continuing to work, working part-time, or retiring and then returning to work (Carr et al., 2020).

Other studies have added nuance to the picture. Findings of a 2017 longitudinal study of cognitive function suggest that work, not retirement, is protective against major cognitive decline when a person leaves the workforce at the normal retirement age, but that early retirement is even more protective against high levels of cognitive decline (Celidoni et al., 2017). Using longitudinal modeling, Westerlund and colleagues (2010, p. 1) showed that younger retirement "did not change the risk of major chronic diseases but was associated with a substantial reduction in mental and physical fatigue and depressive symptoms, particularly among people with chronic diseases."

One research team evaluated the relationships between individual characteristics and life satisfaction among people working after retirement age, defined as the combination of pension income and participation in paid work, in the European Union (EU). Based on data from 16 countries, the "relationship between life satisfaction and working after retirement" age depends "on individual pension income and the resources available" to the person (Dingemans and Henkens, 2019, p. 662). Life satisfaction is greater among working retirees in lower-income EU countries than among their counterparts in higher-income EU countries. Life satisfaction is also greater for working retirees without partners (Dingemans and Henkens, 2019).

This literature emphasizes that there is no yes or no answer to whether work or retirement is better for healthy longevity. Rather, it suggests the need to study subgroups to determine which individual and work characteristics can lead to better health in work and retirement.

> Finding 3-1: The impacts of work and retirement on older people are heterogeneous. Overall, working has health benefits for many older people while adversely affecting the health of others. The same is true for retirement. Evidence that increasing the retirement age improves health is scant and inconclusive.

KEY TARGET: WORK AND RETIREMENT

Increasing Labor Force Participation Among Older Workers

> While stereotypes portray older workers as less healthy, productive, and tech-savvy than their younger counterparts, the evidence suggests that older workers in knowledge jobs are superior in judgment, reliability, and mentoring skills and are indeed capable of mastering the technology requirements of their jobs. Along with an increased sense of competence, older workers become motivated to use their vast repertoire of skills to help others. All of these factors serve to improve workplace climate and reduce turnover among workers of all ages, thus lowering costs for employers. (Stanford Center on Longevity, 2021, p. 4)

To avoid a potential crisis arising from population aging, governments need to harness healthy longevity to support their economies. The most direct way to harness healthy longevity in service to the economy and government capital is to increase labor force participation among healthy older people. Government capital, in turn, can be used to provide support to advance healthy longevity (Aksoy et al., 2019). The potential gains in GDP and capital are tremendous. Barrell and colleagues predicted in 2009 that adding 1 year of work in the United Kingdom would raise its GDP by more than 1.5 percent in approximately 4 years, in addition to increasing total and government capital (Barrell et al., 2009).

In higher-income countries, the goal is to enable healthy people, especially those under age 65, to work for longer if they choose to. Lower-income countries already have high labor force participation rates among people over age 65 because many people work outside of the formal economy surviving on subsistence-level incomes. Absent a social pension, these people must work until they are physically or cognitively incapable of doing so. As discussed in Chapter 4, the goal for people with low incomes in all countries is to provide pensions.

A common objection in response to proposals to increase labor force participation among older people is that doing so will decrease employment opportunities for younger people. The "lump of labor fallacy," which assumes that economies are inelastic and the number of jobs is static, "is probably the most damaging myth in economics" and has been largely discredited (Börsch-Supan, 2013, p. 10). Studies of 12 countries in North America, Europe, and Asia, for example, demonstrate that labor force participation rates among older people are positively correlated with labor force participation rates among younger people (Böheim, 2019).

Differences in Labor Force Participation Rates

Labor force participation rates differ across countries and over time. Within Organisation for Economic Co-operation and Development (OECD) countries,

the exit age from the labor force is a U-shaped curve (see Figure 3-2). Policies that encouraged older workers to retire and the global financial crisis of 2008 drove declines in labor force participation among older people. The goal of these policies was to decrease youth unemployment by having fewer older workers, but as discussed above, this notion has been discredited, and youth unemployment remained high even after older workers retired at earlier ages.

In the United States, the only age group that has seen increased labor force participation rates year after year since 1996 is people aged 55 and older (see Figure 3-3). That labor force participation at younger ages is shrinking emphasizes the need to maintain or increase participation among people aged 55 and older. The steep declines in overall participation rates that occur after age 55 may be a high-value target for incentives to encourage healthy participants to continue working up to and even after normal retirement age (the age when a person is eligible for full government pension benefits). Similar patterns have been observed in Europe. Consistent with this growth in older workers, the United States has seen a radical shift in workers' retirement expectations: the percentage of workers expecting to work past age 65 tripled between 1991 and 2018 (Munnell et al., 2019).

Labor force participation rates for those older than 64 differ dramatically from high- to low-income countries. Europe has the lowest participation rates for high-, upper-middle-, and lower-middle-income countries, with rates of 6.89, 6.0, and 13.6, respectively, while low-income countries in Asia and Africa have an average participation rate of 51.4, explained by the absence of pensions and people's need to work to survive (Staudinger et al., 2016).
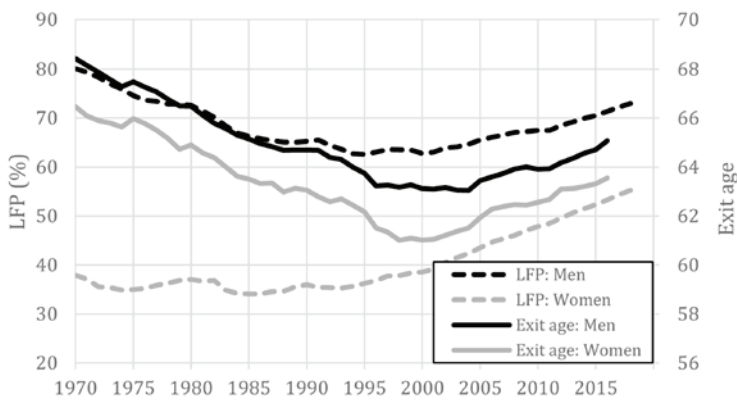
FIGURE 3-2 Labor force participation at ages 55–64 (left axis) and average labor market exit age (right axis) for Organisation for Economic Co-operation and Development countries.
SOURCE: Boissonneault et al., 2020.
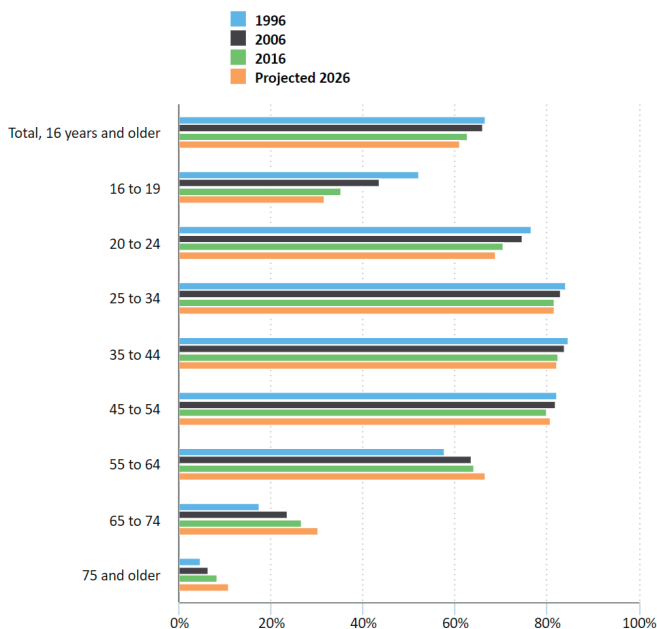
FIGURE 3-3 Civilian labor force participation rate by age, 1996, 2006, 2016, and 2026 (projected).
SOURCE: U.S. Bureau of Labor Statistics, 2019.

Current labor force participation among people aged 65 and older debunks the flawed assumption that people in this age group are unproductive. In 2018, their participation rates ranged from 13.7 percent in high-income countries to 49 percent in low-income countries. In high-income countries, their participation rate increased by 38 percent between 2000 and 2018, while the rate in lower-income countries saw minimal change (UN Population Division, 2018) (see Figure 3-4). Even now, the percentage of people aged 50 and older who are healthy exceeds the percentage in the labor force, suggesting that, with the current levels of good health, many people who have exited the workforce have the health that would enable them to participate.

Longer Working Life

As with overall labor-force participation, structural, cyclical, and accidental factors play an important role in shaping labor-force participation of older adults. However, labor-force participation of older adults also has its own specificities. Two key conceptual perspectives that help to further unravel labor-force participation of older adults are whether they need, want, and are healthy enough to
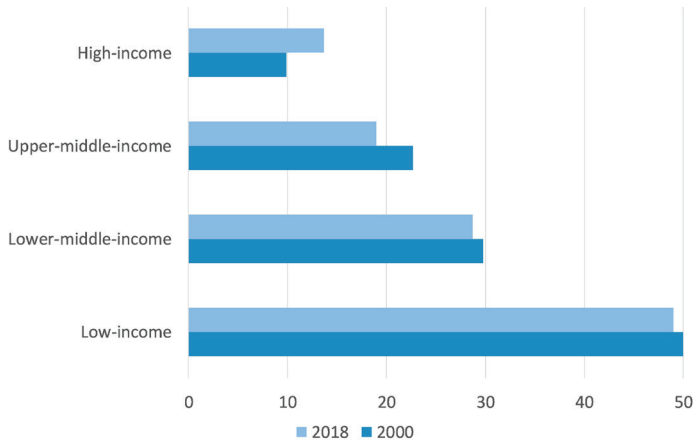
FIGURE 3-4 Labor force participation rates among those aged 65+ by country income level.
SOURCE: Adapted from UN Population Division, 2018.

> work (i.e., supply side) and whether employers retain, train, or hire them (i.e., demand side). (Staudinger et al., 2016, p. S284)

As the above quotation suggests, attempts to influence labor force participation need to address the supply side by encouraging older people to remain in or rejoin the labor force. Reasons for remaining in the workforce past normal retirement age (the full pension eligibility age) vary. A common reason across countries is the need for income, as is the case in low-income countries (Staudinger et al., 2016). In Europe, people who lack the resources to retire include those who have engaged in more lifetime part-time work or self-employment and divorced women who do not remarry; thus, "[i]nequalities that develop across the course of work careers seem to continue after retirement, which may also have serious policy implications" (Dingemans and Möhring, 2019). In a U.S.–based survey about working, roughly half of those aged 62 and older rated "the ability to provide for themselves financially" as important or essential (Maestas et al., 2018).

Table 3-1 summarizes individual, job, family, and socioeconomic influences found to be associated with workforce exit in OECD countries. Individual factors include enjoyment in work, satisfaction in using skills, a sense of accomplishment, the ability to be creative, work ethic, and generativity (Kooij et al., 2008); personal growth, striving to help other people, and contributing to society (Kooij et al., 2011); and remaining active (Staudinger et al., 2016).

Given the steep increase in workforce departures beginning at about age 50 in OECD countries, it is important to understand why people in this age group

TABLE 3-1 Factors Associated with Workforce Exit, Organisation for Economic Co-operation and Development Countries

Individual	Job	Family	Socioeconomic
• Demographic characteristics (age, education) • Personality, needs, motivations, and values • Knowledge, skills, and abilities • Attitudes toward work and retirement • Health and lifestyle • Employment history • Income, wealth, and health insurance	• Job characteristics • Age stereotypes and norms, diversity and discrimination • Human resources policies and practices • Employer-provided pension plan • Training and skill development opportunities	• Caregiving responsibilities • Partnership status and relationship's quality • Partner's retirement status	• Social norms about retirement • Macroeconomic conditions • Social security systems

SOURCE: Boissonneault et al., 2020.

leave the workforce. One study of workers who retired earlier than planned found poor health to be the most common reason. Health-related disabilities impact the ability to work in 25 percent of workers aged 60–61, and poor health decreases an older worker's chances of working longer. Workers in poor health are more likely than their healthier counterparts to transition out of work and into unemployment, disability pensions, and early retirement (Dingemans and Möhring, 2019).

Less common factors influencing a person's decision to leave the formal workforce earlier than planned include caregiving responsibilities and job loss without replacement. Other factors include unavailability of the jobs or job characteristics that would lure people away from leisure (Staudinger et al., 2016) and poor physical or overly demanding work environments (Nilsson, 2016).

Age Discrimination and Ageism in Employment

Older people who want to work face employment discrimination and ageism, which affects their ability to continue to work and be hired. People in the United States who are laid off after age 50 are far less likely than younger workers to be reemployed. Two of three respondents to an AARP survey of people in the United States over age 45 who were employed or looking for work reported seeing or experiencing age discrimination in their workplace (Perron, 2018). The San Francisco Federal Reserve conducted a correspondence study in which it submitted more than 40,000 realistic job applications for 13,000 positions for young (29–31), middle-aged (49–51), and older (64–66) people. Older female applicants for low-skill administrative and sales positions received 47 percent and 36 percent

fewer callbacks, respectively, compared with their younger counterparts. Older male applicants for sales positions received 30 percent fewer callbacks compared with their younger peers. Older versus younger male applicants for janitorial and security positions received fewer callbacks, but the difference was not statistically significant (Neumark et al., 2017). Likewise, a HelpAge International report documents extensive employment discrimination in African countries (Nhongo, 2006). Findings of a recent study evaluating age and gender requirements in job boards in China and Mexico were similar (Helleseter et al., 2020). The researchers examined the characteristics of job ads across multiple online job boards, looking specifically for age, gender, and skill requirements. They found that more than 77 percent of open job postings on an online job board popular for low-skilled positions specified a maximum age, which essentially eliminated all possibility of older workers obtaining those positions. When they combined age and gender requirements across all four job posting sites, they found a striking difference. Across three job boards in China and one in Mexico, the number of postings specifying gender was roughly equal, but more postings seeking women were limited to those under age 25 (ratio of 1.4:1). Postings seeking workers over age 35 leaned toward men, with ratios of 2.5:1, 4:1, and 5:1 applying for the job boards in China and 2.5:1 for the job board in Mexico. Although the data do not extend to older ages, the apparent discrimination against women as they age has troubling implications for obtaining these jobs.

Older Workers' Productivity and Value on Intergenerational Teams

A significant barrier to labor force participation is the perception that older people bring down the economy and the workplace. The authors of one study concluded that "population aging slows earnings growth across the age distribution" and "leads to declines in the average productivity of workers in all age groups" (Maestas et al., 2016, p. 3). Börsch-Supan and Weiss (2016) suggest that these studies reflect measurement, selectivity/endogeneity, and aggregation challenges. To overcome these challenges, they conducted a productivity study in a truck manufacturing plant with laboratory-like conditions and a large number of observations. They found no evidence to support the notion that older workers (up to age 65) are less productive than younger workers. They found that older workers were slightly more likely to make errors, but they rarely made severe errors, and the evidence suggested that experience kept their productivity from declining. Another recent study found that productivity declines are reduced or eliminated when older workers are healthy (Cylus and Al Tayara, 2021), suggesting that the magnitude of older workers' impact on productivity is not homogeneous or fixed and can be offset by improved health.

Examining the benefits of employing older workers, Mercer, a human capital measurement and management firm, found that the contributions of older workers change over time, with their individual contributions declining as the productivity

of people around them increases. The study also found that older workers have longer tenures, and workers of all ages stay in a job longer when they have older managers (Stanford Center on Longevity, 2017).[3] Two recent studies considering the relationship between positive business outcomes and intergenerational workplaces help explain Mercer's observations. The first found a relationship between being involved in knowledge transfer among older and younger workers and the retention of both groups of workers (Burmeister et al., 2020). The second found that "age diversity was positively associated with performance" as a result of "increased human and social capital," with an even greater effect in settings where employees work in diverse environments and when the management is age-inclusive (Li et al., 2021, p. 71), and an OECD study linked a 10 percent higher share of workers aged 50 and older with firms being 1.1 percent more productive (OECD, 2021).

Older people are successful as entrepreneurs as well. Venture capitalists invest heavily in people in their 20s and 30s on the assumption that they have the best chance of creating a high-growth start-up. But a recent analysis suggests that the most successful founders of "growth-oriented" firms with large economic impacts are between their late 30s and early 50s, with those at age 65 having more success than those under age 25 (Azoulay et al., 2020).

Incentives for Older People to Work

The most common strategy governments have used to increase labor force participation among older workers is raising the retirement age. In member countries of the OECD and G20, for example, pension ages are rising under pension reform laws, with Denmark instituting the most extreme increase in normal retirement age, from age 65 in 2019 to a projected age 74 in 2070 (see Figure 3-5). Italy, the Netherlands, and Estonia have enacted a future retirement age of 70 or older, with few workers expected to have a future retirement age below 65 (OECD, 2020). Between 2017 and 2019 in OECD countries, most pension reforms loosened age requirements for eligibility, increased benefits (including safety net pensions aimed at preventing poverty among older people), expanded coverage, or encouraged private savings (OECD, 2020).

Raising the pension eligibility age increases labor force participation among older people, but likely at a cost to vulnerable older adults. France increased its retirement age, for example, but experienced high rates of unemployment for people who were between the old and new retirement ages, likely because the government had increased labor supply while doing nothing to stimulate demand for that increased supply (Guillemard, 2016). Another analysis found that changing the normal retirement age from 65 to 67 netted only an additional

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[3] Presented by Haig Nalbantian, a speaker at the conference that is the subject of the report, who is a senior partner and the cofounder of the Workforce Sciences Institute at Mercer.
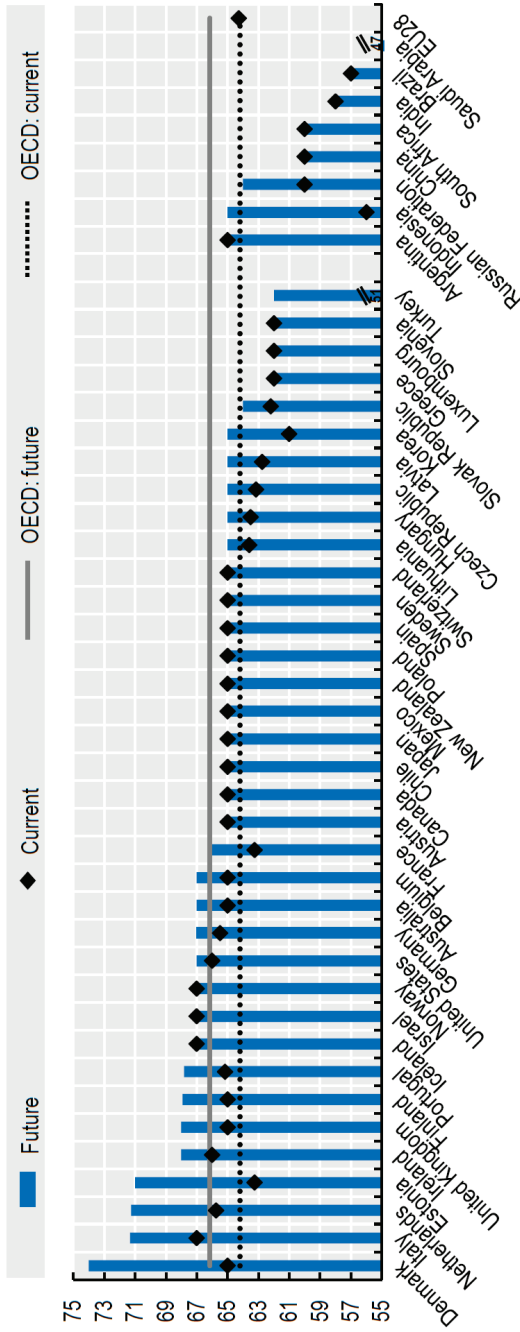
FIGURE 3-5 Normal retirement age for men entering the labor market at age 22 with a full career.

NOTE: OECD = Organisation of Economic Co-operation and Development.

SOURCE: Republished with permission of OECD, from *Pensions at a glance 2019: OECD and G20 indicators*, OECD, 2019; permission conveyed through Copyright Clearance Center, Inc.

0.6 years of work, and that individuals with low education levels and blue collar jobs suffered under the changes because of the challenge of getting a job at older ages (Etgeton, 2018).

Given concerns about pension eligibility resulting in more income inequality, countries have initiated alternative approaches to increasing labor force participation rates and reaping the associated GDP boost through incentives. Between 2017 and 2019, OECD countries implemented the following policies to create incentives to continue to work, instead of punishing those who do not remain in the workforce:

- increasing earnings exemptions (Canada);
- paying a lump sum to people who work more than a specified number of hours after reaching retirement age (Denmark);
- abolishing the maximum limit of pension accrual years (Belgium); and
- instituting age-targeted tax credits for people over age 65 who continue working (Sweden) (Laun, 2017; OECD, 2020).

The Future of Work and Retirement for Older People

Some have called for an end to retirement as an either/or state. Even now, people want a "glide path" into retirement whereby they can reduce hours, have more time off, and possibly change roles instead of abruptly leaving the workforce. Emerging patterns among current older workers provide insight into what will keep future people in the workforce. For example, older Americans have specific preferences about working past retirement, such as setting their work schedule, limiting their physical activity, having paid time off, and working alone. Figure 3-6 compares the preferences of four age groups in the United States—25–34, 35–49, 50–61, and 62+—with respect to their willingness to pay for job amenities in proportion to their wages. In all but two instances, the value assigned to job amenities was higher among older compared with younger people. The exceptions were "training opportunities" and "frequent opportunities to serve," also described as opportunities for meaningful work. Lower rates of training and fewer opportunities to serve that are observed may reflect older workers' preferences (Maestas and Jetsupphasuk, 2019; Maestas et al., 2018).

While these findings likely apply in other high-income countries, they may be less relevant in low- and middle-income countries, where more older workers are driven by need, not preferences. However, older workers in low- and middle-income countries may benefit from changes in job characteristics that are more favorable for older workers. For example, automation is replacing more physically demanding jobs in Thailand, and this shift is allowing older workers to remain in the workforce for as long as they choose (Moroz et al., 2021). Employers also can create more supportive environments for older workers relative to current workplaces by, for example, allowing flexible work schedules; providing
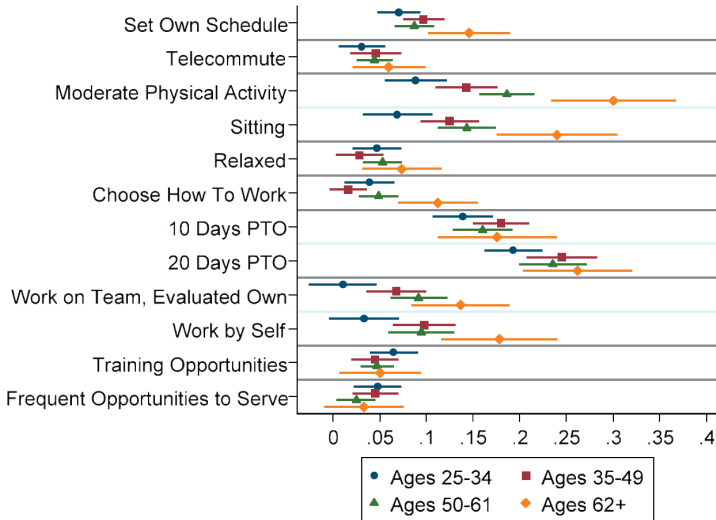
FIGURE 3-6 Estimates of willingness to pay for job amenities by age group, expressed in proportion to respondent wage.
SOURCE: Maestas et al., 2018.

part-time work; and funding job retraining for people whose jobs involve manual labor that they are no longer able to perform, allowing them to transition to more appropriate roles.

In some instances, especially in the United States, hiring older workers can be more costly than hiring younger workers. In the United States, for example, employers pay more for health insurance for older workers than for younger workers. When considering options for increasing labor force participation, governments may wish to focus on laws and regulations that create disincentives for hiring older workers.

Workers in the Informal Economy

The percentage of the workforce participating in the formal economy varies among global regions. In contrast with work in the informal economy, employment in the formal economy is characterized by employment agreements, scheduled hours, consistent and scheduled pay, and participation in private and government pensions. Much of the caregiving and domestic workforce, overwhelmingly female, works in the informal economy. In addition, the world in general has seen the rise of new forms of work other than full-time work with benefits, including work arrangements and short-term contracts without guaranteed hours, sometimes described as the gig economy. Among OECD countries, informal and new forms of work account for a third of employment (OECD, 2020). In comparison, 70

percent of employment in emerging markets and developing economies is in the informal sector, with self-employment accounting for different proportions of the informal workforce in different regions (Ohnsorge and Yu, 2021).

Employment in the formal economy comes with legal protections and minimum standards for financial stability. The informal economy and new forms of work are typically flexible but come without protections such as from dangerous working conditions, unpredictable income, low earnings, and limited access to health care and pensions (OECD, 2020). In the United States, where employers provide a majority of health insurance coverage, workers outside of the formal economy often lack access to affordable health insurance. Worldwide, workers in the informal economy and new forms of work are vulnerable to income disruption and job loss and may lack access to a financial safety net and pensions (Ohnsorge and Yu, 2021).

From the government perspective, both informal and new forms of work present challenges. According to a World Bank report, "a large informal sector weakens policy effectiveness and the government's ability to generate fiscal revenues" (Ohnsorge and Yu, 2021, p. 16). Governments that lack resources have a limited ability to shrink the informal sector by providing social protection programs and public services (Ohnsorge and Yu, 2021; Schneider et al., 2010). This, in turn, limits governmental engagement by private-sector companies and workers and increases the size of the informal sector (Loayza, 2018; Ohnsorge and Yu, 2021; Perry et al., 2007).

The COVID-19 pandemic has been devastating to vulnerable populations around the world, and informal-sector workers are no exception. According to the World Bank, during the pandemic, workers in the informal sector were more likely than those in the formal sector to lose jobs, suffer income losses, live in areas with poor access to public health interventions and sanitation, and lack access to social safety nets (Ohnsorge and Yu, 2021).

Governments can implement policies to promote the transfer of the informal sector's resources to the formal sector and to provide better public services and social safety nets for workers in the informal sector, especially during and in the aftermath of the pandemic (Ohnsorge and Yu, 2021). Doing so can reduce inequities between workers in the formal and informal sectors. Establishing legal rights for the working poor, including improved access to the justice system and property, business, and labor rights, has the potential to help workers in the informal sector by providing improved working conditions and the right to seek payment if it is wrongfully withheld (Dasgupta, 2016). Finally, governments and corporations can set targets for hiring people into the formal economy by providing on-the-job training, given that many workers in the informal economy lack education and training (Dasgupta, 2016). Implementing policies to protect workers in the informal sector in the near term is important in light of forecasts of a postpandemic decrease in physical capital, "erosion of the human capital of the unemployed," and weakened global trade (Ohnsorge and Yu, 2021, p. 5).

Finding 3-2: If older people were to stay in the labor force longer in high-income countries, it would increase the gross domestic product, government capital, and personal capital.

Finding 3-3: Evidence suggests that older adults who work do not take away jobs from younger workers.

Finding 3-4: Workers in the informal economy are at significant risk of financial instability.

Conclusion 3-1: Raising the pension eligibility age increases the length of time people stay in the workforce, but without safety nets for people who cannot find jobs or are unable to work, the policy penalizes people with limited resources.

Conclusion 3-2: Raising the pension eligibility age increases workforce participation by older workers, but doing so to improve health is not justified by the evidence, and it may increase inequality.

Conclusion 3-3: Maintaining economic equilibrium as the population ages will require increased workforce participation by older people.

Conclusion 3-4: Incentives to recruit and retain older workers will be an integral part of increasing workforce participation by older people.

Conclusion 3-5: Governments can increase voluntary workforce participation among older workers by creating incentives to work and removing barriers to work.

Recommendation 3-1: Governments, in collaboration with the business sector, should design work environments and develop new policies that enable and encourage older adults to remain in the workforce longer by
a.   **providing legal protections and workplace policies to ensure worker health and safety and income protection (including during periods of disability) across the life course;**
b.   **developing innovative solutions for extending legal and income protection to workers participating in alternative models of work (e.g., gig economy, informal sector);**
c.   **increasing opportunities for part-time work and flexible schedules; and**
d.   **promoting intergenerational national and community service and encore careers.**

KEY TARGET: VOLUNTEERING

Older adults have more prosocial tendencies than younger people (see Chapter 4). Generativity, the act of contributing to nonfamily members of younger generations, is a manifestation of these prosocial behaviors. Generative acts among older adults include contributions through family roles, friendship, community activity, volunteering, and work. Prosocial behaviors that overlap with generative acts include volunteering formally or informally (Wenner and Randall, 2016). The emphasis of this section is on the role of formal volunteer structures for a future of healthy longevity. Although it is not the emphasis of this section, the commission also recognizes the importance of informal contributions older people make to family, friends, and community.

Benefits to Older Volunteers

Formal volunteering in later life supports healthy longevity, enhances an older person's sense of meaning and purpose, and provides financial and social value to society (Carr et al., 2018). Studies have shown positive effects of volunteering on mortality risk (Harris and Thoresen, 2005), cognitive function (Guiney and Machado, 2018), depression (Li and Ferraro, 2005), physical function, positive affect, and happiness (Anderson et al., 2014). "Practices of contributing, giving, and passing on have an important role in the self-identification of older people as contributing citizens, as individuals with self-worth, significance, and meaning" means that volunteering meets "basic psychological needs of self-esteem, socialization, life satisfaction, and contribution to others" (Stephens et al., 2015, p. 24).

Impacts of volunteering vary among subpopulations, and some findings in this regard are perplexing. One study found that volunteering reduced mortality risk in healthy older people but not those in fair health or with functional limitations. Another study found an association between volunteering more than 800 hours a year and worse negative affect among people without a partner and with a moderate level of education. In many cases, those people who are highly vulnerable benefit the most, with the strongest associations being found between

- higher level of happiness and those of lower socioeconomic status;
- positive affect and resilience and having more chronic conditions;
- reduced depression and older people with dual sensory loss;
- reduced mortality and nondrivers, especially in rural areas; and
- reduced mortality and older adults with low social interaction (Anderson et al., 2014).

Who Volunteers?

Compared with older people who do not volunteer, older volunteers are, on average, healthier, wealthier, younger, and more educated (Anderson et al., 2014). Volunteering is more prevalent among people who attend religious services relative to those who do not, with differences among religions and denominations. Many groups of older people face barriers to volunteering, and often those who face the most barriers would benefit most from volunteering. There is also tremendous variation in rates of volunteerism among countries, with a 10-fold variation in rates across Europe. The wealthiest countries have the highest rates of volunteering (Southby et al., 2019).

For older people, barriers to volunteering include "poor health and physical functioning, poverty, stigma, lack of skills, poor transport, time constraints, inadequate volunteer management, and other caring responsibilities" (Southby et al., 2019, p. 911). Volunteering also consumes resources, so people with fewer resources may lack the opportunity to benefit from volunteer opportunities or be limited to specific volunteer roles or organizations. Older people, among other subgroups, report that they do not feel welcome in some volunteer programs (Southby et al., 2019).

The combination of barriers driving lost opportunities for improved health creates concerns about volunteerism and equity that need to be addressed if communities or countries choose to promote volunteerism. One publication makes the case that online volunteering shows promise for enabling volunteerism among people with mobility challenges and others who cannot participate in person, and may reduce ethnic and racial discrimination encountered by members of some groups (Seddighi and Salmani, 2018).

Societal Benefits

Programs using older volunteers can have significant societal value beyond their impacts on the volunteers. Experience Corps is the first evidence-based model for senior volunteering designed for both societal impact and health promotion and improved well-being for the older volunteers. The program involves placing a minimal number of older volunteers in schools and training them in teams to enable a team dynamic to thrive. This evidence-based senior volunteer program was designed to create multiple positive outcomes for

- children's academic success in public elementary schools;
- older volunteers' health, function and well-being, and ability to meet generative goals;
- teachers' and schools' success in educating and in improving the social climate; and
- communities' social cohesion.

The program's creators wanted to show that volunteer programs could provide meaningful and high-impact roles for older people by using their assets effectively and meaningfully and bring generative fulfillment by supporting the academic success of the next generation (Fried et al., 2004).

Experience Corps was designed using public health science to amplify the physical, cognitive, and social activity and engagement of older adults within and beyond their existing roles. Intentionally placing older volunteers in a school and training them in teams created efficiencies within the schools and new vehicles for establishing social networks (Fried et al., 2004). Students' behavior, school climate (Rebok et al., 2004), and teacher efficacy and satisfaction improved in Experience Corps schools (Martinez et al., 2010). One critical design element enabling participation by lower-income volunteers was a stipend that offset some costs of volunteering (Tan et al., 2010). Box 3-1 includes a description of a successful volunteer program in South Africa.

The Value of Volunteering

A 2020 economic analysis of work, volunteering, caring for grandchildren, and support for non–household members in Europe and the United States quantified market and nonmarket contributions of people over age 50. The analysis showed that older adults contribute 29 percent (Europe) and 40 percent (United States) of GDP per capita through market and nonmarket activities (see Figure 3-7). For those over age 60 in Europe and the United States, the value of nonmarket contributions was estimated to be 50 percent and 84 percent, respectively, of the value of market contributions. It is important to note that the value of contributions measured in the study is less than the actual value contributed by older people because it does not include the value of household activities or care for disabled adults within the household, such as disabled adult children or spouses (Bloom et al., 2020).

BOX 3-1
South African Peer Support Intervention

A program showed the impacts older volunteers had in a low-income area in Cape Town, South Africa. To address a lack of resources to support older people, a peer support intervention was implemented to determine whether a low-cost program that included visits to older people identified as lonely could impact their health and social outcomes. The simple telephone and home visits increased "self-reported well-being, emotional and informational support, social interaction, and physical activity"; improved mood scores; and reduced loneliness.

SOURCES: Geffen et al., 2019; UN Women, 2021; UN Women et al., 2020.
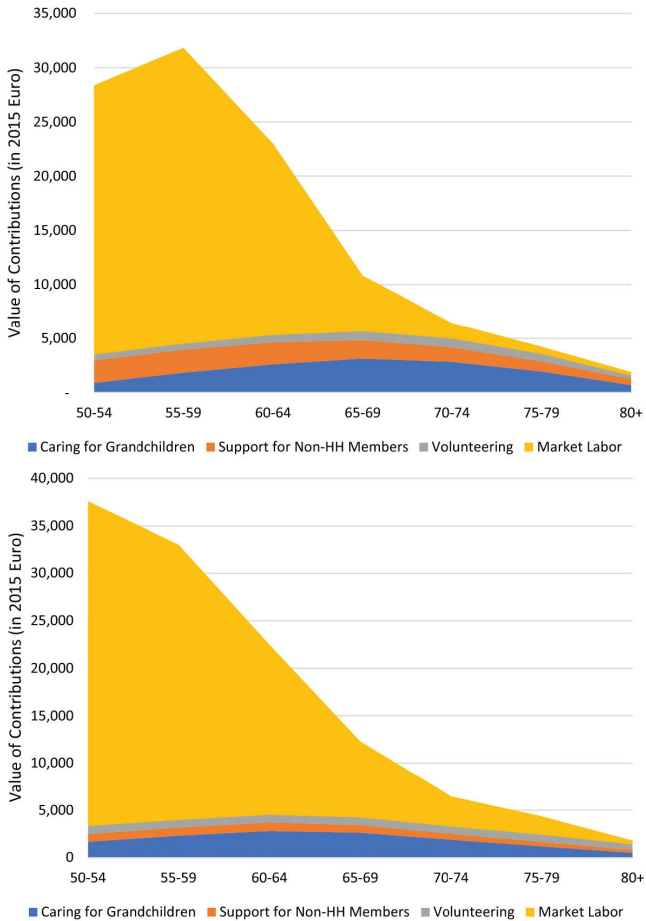
FIGURE 3-7 Value of contributions by age group in the United States (top) and Europe (bottom).
NOTE: Non-HH = non-household.
SOURCE: Bloom et al., 2020.

Levers for Action

Volunteerism, along with other informal volunteer activities of older adults, can generate social capital, benefiting both the volunteer and the recipient of the volunteer services. The commission agreed that the evidence justifies government investments in shoring up and expanding existing volunteer programs. Some commissioners, but not all, went a step further in calling for major investments in national programs for older volunteers.

Before scaling up volunteer programs, it will be necessary to overcome the many barriers that prevent older adults from volunteering. It is also important to ensure that the failure to volunteer does not stigmatize people who do not volunteer.

Finding 3-5: Evidence suggests that participating in formal volunteer programs improves health outcomes for older people. People on the receiving end of volunteer efforts also benefit.

Conclusion 3-6: To maximize the value of volunteer contributions to both older people and society, existing government and private-sector structures need to encourage the involvement of older volunteers; formal programs need to provide meaning and purpose for volunteers, along with financial support to offset costs they may incur; and governments at all levels need to create or shore up existing volunteer programs for older people.

Research Questions

Research in the following areas is needed across all countries and all ages to better understand and promote volunteering. Data to support this research would be best gathered by collaborations between researchers and volunteer organizations:

- how to measure the impact of global volunteer inputs, and
- time-use and other surveys of volunteers.

KEY TARGET: LIFELONG EDUCATION AND RETRAINING

This report envisions a future in which the 20th-century model of remaining in one career for most of one's adult life is rare. Instead, the commission envisions multiple careers across a person's working life. To make this vision a reality, education and retraining will be critical.

Education during early childhood and young adulthood influences health and functioning across the life course. The relationships are strong, even if the mechanisms are still being disentangled. Evidence suggests two main influences of education on health. First, education itself—independent of work and labor force participation—has a beneficial impact on late-life healthy longevity. Second, education puts people on a social and career trajectory leading to occupational gains and more labor force participation. Postsecondary education also influences health into older ages (Böheim et al., 2021). Notably, historic declines in the incidence of dementia have been linked to increased educational attainment (Valenzuela and Sachdev, 2006).

Literacy and Numeracy

Literacy and numeracy are foundational to work, financial literacy, health literacy, and even community and social engagement. Literacy is defined as "understanding, evaluating, using and engaging with written text to participate in society, to achieve one's goals and to develop one's knowledge and potential" (OECD, 2012, p. 20). Numeracy is "the ability to access, use, interpret, and communicate mathematical information and ideas, to engage in and manage mathematical demands of a range of situations in adult life" (OECD, 2012, p. 34). The good news is that global literacy rates have climbed steadily for the past 50 years, especially among women (Roser and Ortiz-Ospina, 2018). The bad news is that today, women over age 65 have the lowest literacy rate, 73 percent, compared with people aged 15–24, whose literacy rate is 91 percent (UNESCO Institute for Statistics, 2017). Among 23 countries included in the Program for the International Assessment of Adult Competencies, 19 percent of people have a very low numeracy level[4] (14 percent) or lack numeracy (5 percent) (Rampey et al., 2016).

The global challenge of low literacy impacts older people's ability to participate in the workforce, volunteer programs, and even family caregiving. An expert in sub-Saharan Africa, for example, described the phenomenon of some older people raising grandchildren who had a limited ability to help their grandchildren with their homework because they had lower literacy than younger people.[5] Older adult literacy is heavily oriented to health. A United Nations Educational, Scientific and Cultural Organization (UNESCO) report states that a focus on promoting youth literacy, versus adult literacy, is appropriate because most improvement in literacy occurs at a young age, and studies suggest that adult literacy programs do not show large effects on national literacy rates (UNESCO Institute for Statistics, 2017). In contrast, the commission emphasizes the need to develop literacy and numeracy across the life course to enable participation in society, the labor force, and health care. Attention to literacy across the life course will help ensure that older people of the future have higher rates of literacy and numeracy than is currently the case.

Completion of Secondary Education

The commission identified completion of secondary education as a target that sets the stage for a life of literacy and workforce entry across countries of all incomes, based on the evidence that more and high-quality education is associated

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[4] "Tasks at this level require the respondent to carry out basic mathematical processes in common, concrete contexts where the mathematical content is explicit with little text and minimal distractors. Tasks usually require one-step or simple processes involving counting, sorting, performing basic arithmetic operations, understanding simple percents such as 50 percent, and locating and identifying elements of simple or common graphical or spatial representations" (Rampey et al., 2016).

[5] Personal communication, Roseline Kihumba, HelpAge International, August 9, 2021.

with increased productivity and earnings. In low- and middle-income countries where informal economies dominate, completing secondary education improves a person's chances of working in the formal economy (Sheehan et al., 2017).

Postsecondary and Lifelong Training and Education

Two recent publications emphasize the importance of adult education and re-training to the longer work lives that will come with healthy longevity (Gratton and Scott, 2016; Stanford Center on Longevity, 2021). Given the recent rate of techno-logical change, it is difficult to predict how education and training will be delivered 30 years from now. The centrality of physical classrooms is already declining, with more students studying online. Yet, while postsecondary online education is growing, it has consistently been found to be less effective than in-person learning. In one recent study, for example, bachelor's degree students in online programs in Columbia had worse academic results compared with those who participated in person, although the results were less conclusive for shorter technical certificate programs (Cellini and Grueso, 2021). These findings suggest an opportunity to develop more effective approaches to distance education, such as virtual reality or augmented reality (Babich, 2019) or some other technology not yet developed.

Currently among age groups in OECD countries, the percentage of people enrolled in all forms of education drops steeply from ages 20–24 (41 percent), to 25–29 (16 percent), to 30–34 (8 percent), to 35–39 (5 percent), to 40–64 (2 percent) (OECD, 2022). The percentage of people over age 65 enrolled in any form of education is so small it is not reported. In a future with multiple career transitions, the commission anticipates higher educational enrollment across the adult life course.

The overwhelming majority of job training and retraining takes place in the workplace. A 2013 UNESCO report describes the value of learning through practice, including for older workers, who can use such learning to remain em-ployable across their working life (Billett, 2013). In 2019, it was estimated that by 2021, 1.7 million more adults in the United States would need a postsecondary degree or certificate to meet market demands. Educational programs that accom-modate the needs of and provide support for older students could help fill this gap (Cummins et al., 2019).

Technical Colleges, Community Colleges, and Global Counterparts

Community colleges and their global counterparts (e.g., colleges of contin-ued education, polytechnic or technical colleges, and technical and continued education) are a common form of tertiary education globally. The U.S. commu-nity college concept has been adopted across countries such as Brazil, Vietnam, and Qatar (Spangler and Tyler, 2011). Benefits of community colleges include a postsecondary curriculum; lower costs than universities; and accessibility for

different types of adult learners, including workplace learners and displaced workers (Raby et al., 2017). Community colleges are also more responsive than other forms of tertiary education to local community needs and more able to shift curriculum (Chase-Mayoral, 2017), but they are not limited to acting locally. More broadly, community colleges in low- and middle-income countries serve as a link between local communities and the global market as students receive developmental, general education that prepares them to transition to skilled employment or a higher university education.

> *Conclusion 3-7: Education at all levels will be critical to healthy longevity. To be effective, educational, upskilling, and retraining programs will need to include delivery through multiple modalities and pedagogical approaches that work for people of all ages, as well as expanded on-the-job and vocational training.*

Metrics and Research Questions

Given that structures to provide education and retraining across the life course are emerging, there are few metrics for such programs that would be of value, beyond a count of enrollment of people over age 25 in these programs, stratified by age in 10-year age bands and gender. To expand the availability of education and retraining options, research on the following questions is needed:

- What characteristics of education and retraining programs would be needed to recruit people over age 25 into postsecondary education?
- Do those characteristics change within age bands across adulthood?

OPPORTUNITIES FOR THE ECONOMY TO SUPPORT HEALTHY LONGEVITY

Businesses can contribute to healthy longevity by retaining and hiring older workers, as described above. They can also contribute by creating products that support health, function, health care delivery, and much more. Coughlin, an expert in products for older adults, describes how "gerotechnology" focuses on health and other basic needs of older people because of the notion that "older adults are problems to be solved." He counters that view with a simile: "Imagine if I gave business students a blank slate to imagine products for a different age group—teenagers, say—and the only products they could come up with were acne creams and crutches for when teens injure themselves performing ill-considered stunts." He characterizes the current approach, which aligns with how businesses and MBA students think about older people, as a "colossal failure of imagination" (Coughlin, 2017, p. 67).

Engineers working on products to support older people start first with the concept of radical empathy: it is necessary to understand what people want before one can begin to design products for them. As Coughlin emphasizes, older people do not want products that make them feel old. Thus, some of the most successful technologies for older people were not designed as technologies for older people. For example, Uber and Lyft have been adopted as transportation for some subsets of older adults (Mitra et al., 2019). Similarly, many caregivers and older adults are using voice-controlled intelligent personal assistants (e.g., Amazon Echo, Google Home). In a study of product reviews, researchers learned that older adults and caregivers use these devices for entertainment (e.g., "For two very senior citizens … we have really had fun with Echo. She tells us jokes, answers questions, plays music."), companionship, home control, reminders, and emergency communication (O'Brien et al., 2020). A third example is the growing use of medical alert devices.

Within health care, there are many ways technology can support older people, particularly in remaining independent. Devices already exist that can passively monitor heart rate and breathing, detect a fall and alert a family member or emergency services, monitor sleep for changes associated with such conditions as pneumonia, or identify neurodegenerative disorders based on gait patterns captured by a floor mat. Additional health-related technologies and pharmaceuticals are described in Chapter 6. There are a number of additional areas of potential for innovation in technology to support older people:

- Communications and human–machine interfaces will be transformed with clear applications for older people who have impairment of one or more sensory systems, but eventually with such broad applications as language processing and remote robotics.
- Consumer industries need to transform for a world with healthy longevity, including food, fashion, appliances, and home furniture, by creating new innovations and businesses, challenging traditional players, and creating new scale players.
- The distinction between products that one wears and those one consumes will blur, bringing together technologies and scale players to interface into horizontals that do not exist, and eventually connecting with health and physiology/performance, blurring the distinction between consumer products and medical products. The development of direct-to-consumer digital health products is beneficial for people with health care needs who lack access to care because of financial, geographic, and other barriers (Cohen et al., 2020). It is important that products be properly regulated and labeled with descriptions that outline digital health facts, specifications for what the products measure, and how those measures can be used.

Countries that can tap the potential in these areas will use consumer insights to understand this new consumer cohort, devise financing and funding models, understand how to protect and use massive datasets to improve lives and be competitive leaders, be innovative in their regulatory environment, and ultimately learn to meet the needs of older consumers in a rapidly iterative way. Some emerging countries will progress ahead of high-income countries, just as Association of Southeast Asian Nations countries did three decades ago in consumer electronics and the automotive industry. Access to capital or a large installed capital base may no longer be an overwhelming competitive advantage. Governments that embrace the challenge of healthy longevity as an opportunity will likely reap the greatest longevity dividends.

Recommendation 3-2: Governments, employers, and educational institutions should prioritize investments in redesigning education systems to support lifelong learning and training. Governments should also invest in the science of learning and training for middle-aged and older adults. Specifically, employers, unions, and governments should support training pilots that allow middle-aged and older adults to retool for multiple careers and/or participate as volunteers across their life span through the development of such incentives as

a. grants or tax breaks for employers to promote retaining and upskilling of employees (e.g., apprenticeship programs, retraining of workers in physically demanding jobs to enable them to engage in new careers in less demanding jobs);

b. special grants to community colleges and universities for the development of innovative models that target middle-aged and older students to support lifelong learning; and

c. grants to individuals for engaging in midcareer training.

METRICS AND RESEARCH QUESTIONS

Suggested metrics for evaluating progress on reaping the longevity dividend include

- older worker labor force participation rates,
- volunteer opportunities available for older adults, and
- proportion of the population involved in volunteer activities.

Research questions include

- development of metrics for identifying any inequality resulting from changes to government policies;
- identification of effective programs for supporting working careers from age 50 onward, ensuring that longer working lives support, rather than detract from, good health;

- the impacts of effective healthy longevity on labor force size and educational choices, and the fiscal implications of these impacts;
- mechanisms for how longer lives boost GDP;
- specific mechanisms responsible for the connections among work, retirement, and cognition;
- the degree of older adults' engagement in volunteering and the impacts of their volunteering, including monetary and nonmonetary value; and
- how to design volunteer roles for older adults that bring valued engagement and societal benefit and improve health and well-being.

CONCLUSION

Older people have intrinsic societal value regardless of their abilities to or choices in work, whether paid or unpaid. People continue to have meaningful roles in society as they age, so defining their engagement and contributions according to their personal values and preferences alongside societal expectations is a game changer.

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4

Social Infrastructure for Healthy Longevity

This chapter lays out key targets for achieving the social infrastructure goals for Vision 2050, outlined in Figure 4-1, along with recommendations and supporting structures to assist in that process. The commission believes that building these important aspects of social infrastructure is critical to healthy longevity but must be carried out in conjunction with efforts in the other domains discussed in this report.

For the purposes of this report, the commissioners build on the World Health Organization (WHO) definition of social determinants of health (SDOH) as conditions or circumstances in which people are born, grow, live, work, and age, all of which are shaped by social, economic, and political forces (WHO, 2022b). Ideally, SDOH would directly enable healthy longevity, but national and global social, political, and economic conditions have instead hindered people's ability to remain healthy as they age. These conditions include unjust economic structures, poorly designed policies and programs, harmful governing practices, unequal shares of social and economic resources, or a combination of all of these factors and more. Consequently, many activists and scholars argue that SDOH are more accurately framed as "social determinants of inequalities in health." The distribution of resources and opportunities—for health care, education, a healthy living environment, and employment—is fundamental to healthy longevity and is directly impacted, either positively or negatively, by public policy. Hence, this chapter's focus is on identifying SDOH policies that can drive health and health equity toward realizing the vision set forth in Chapter 2.

This chapter also presents current evidence on key SDOH and their interactions across individual and institutional levels, highlighting programs, structures, and policies that promote equitable outcomes in healthy longevity, along with

87

Social Infrastructure Key Targets

Prosocial strengths of older people, ageism and age discrimination, social inclusion, financial security in retirement, and digital literacy

2022 - 2027

Recommendations for Next 5 Years

(full text at end of relevant section within Chapter 4)

4-1. Develop evidence-based strategies to reduce ageism
4-2. Develop plans to ensure basic financial security for older people
4-3. Develop strategies for increasing financial literacy

2022 - 2050

Examples of Supporting Structures

- Laws and policies to eliminate age-based discrimination
- Public information campaigns promoting the value of older people and attacking stereotypes
- Multigenerational advocacy to fight age discrimination to accomplish shared goals
- Multigenerational approach to policy and action to strengthen social cohesion, reduce loneliness
- Pension and social protection systems that include people outside the formal economy
- Programs promoting individual savings and financial literacy
- Access to secure banking systems and investment opportunities

2050

Goals

4. Social cohesion augmented by intergenerational connections and the creation of opportunities for purposeful engagement by older people at the family, community, and societal levels
5. Social protections and financial security that mitigate the effects of financial vulnerability at older ages

FIGURE 4-1 Social infrastructure for healthy longevity roadmap.

relevant case studies. Promising SDOH solutions, if brought to scale, can have far-reaching positive effects for societies worldwide and contribute to global healthy longevity.

The remainder of this chapter describes the key targets that the commission selected based on their ability to catalyze change toward healthy longevity: capitalizing on the prosocial strengths of older people, combating ageism, fostering social inclusion, ensuring financial security in retirement, and achieving digital literacy. The discussion of these key targets draws on evidence and recommendations from international reports, highlighting alignment with related international frameworks. In addition to providing background information, the section on

each key target provides examples of case studies and interventions that show promise for moving toward healthy longevity. Finally, several sections conclude with levers for empowering change, including metrics for assessing the status of progress on the target and research questions to be addressed.

SOCIAL DETERMINANTS OF HEALTH

Understanding and addressing the various types of SDOH across the life course are important goals because experiences in early or young adult life can have long-term implications and determine whether people will age well or poorly and achieve their full potential. These determinants can arise at various points along the life course and may not be directly linked to health or to factors that can be influenced by a health system. The following are examples of SDOH that can affect health and equity (WHO, 2022b):

- "income and social protection;
- education;
- unemployment and job insecurity;
- working-life conditions;
- food insecurity;
- housing, basic amenities, and the environment;
- early-childhood development;
- social inclusion and nondiscrimination;
- structural conflict;
- access to affordable health services of decent quality"; and
- health, financial, and digital literacy.[1]

Researchers estimate that 10–20 percent of health outcomes are influenced by clinical care (Magnan, 2017), while the remaining 80–90 percent are influenced by SDOH and other related factors, such as health behaviors and the environment. Accordingly, addressing these factors is of critical importance to increasing the potential for global healthy longevity.

This chapter addresses the key targets related to social infrastructure the commission believes are most integral to healthy longevity. Key targets include capitalizing on the prosocial strengths of older people, combating ageism, fostering social inclusion, ensuring financial security, and improving digital literacy. Other SDOH are discussed in Chapters 3, 5, and 6. It is beyond the scope of this report to analyze the effects of all SDOH, so the commissioners prioritized the inclusion of those that are most important to tackle in the near term.

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[1] Although health, financial, and digital literacy is not an official determinant listed by WHO, the commission asserts that it is a vital determinant of health equity.

Effects Across the Life Course

Healthy longevity can be achieved only by making changes across the life course. The commission emphasizes the numerous opportunities to improve healthy longevity among younger people, at a time when their actions, experiences, and environmental exposures have a significant influence on their health trajectory across the life course.

Although the key targets in this report are important for today's older people and, in most cases, all people, other interventions targeting younger people will also be needed to improve healthy longevity for older people of the future. For example, high-quality "early-childhood development and education are key determinants of future health and well-being" (Paris, 2018, p. 16). The advantageous lifelong effects of a supportive and safe childhood and the beneficial role of socioemotional competence in individual health and well-being influence future health. For example, a Jamaica-based study studied outcomes in children who were part of a program in which community health workers taught parenting skills and provided nutritional supplementation over a 2-year period (Gertler et al., 2014). The children who received the intervention realized 25 percent higher earnings 20 years later compared with the control group. Thus, early-childhood development sets the stage for lifelong thriving and is a cost-effective investment that countries can make to improve lifelong health and well-being. While it is beyond the scope of this report to discuss such interventions and their effects in detail, many reports, such as the WHO (2009) report *Social Determinants of Health and Well-Being Among Young People*, address the relationship between SDOH and younger people.

Poverty prevention, education, secure and safe housing, social support systems, and access to integrated health systems at all ages are also important for ensuring healthy longevity. Structural changes in social policies and practices can help to avoid negative impacts on health that stem from social and economic disadvantage. Public understanding that poor health outcomes and unhealthy aging are socially determined can empower people to demand change from their governments. Medicalizing these social determinants and needs and focusing on them at an individual level will improve health status only for those individuals at that particular point in time. To have a real effect on populations, investments must be made in the community, addressing social needs and risks at the system level, with downstream benefits for the entire community. For example, providing access to food for a patient who presents at a health clinic will help that person for a discrete period of time, whereas ensuring that there are markets in a neighborhood without access to food can help the entire community.

Making systemic investments is key to leveraging an unprecedented opportunity to improve health on a global scale through focused attention on the needs of disadvantaged populations. To represent the relationships between structural drivers and various SDOH and their combined impact on equity, the commission adapted Solar and Irwin's (2010) conceptual framework (see Figure 4-2).
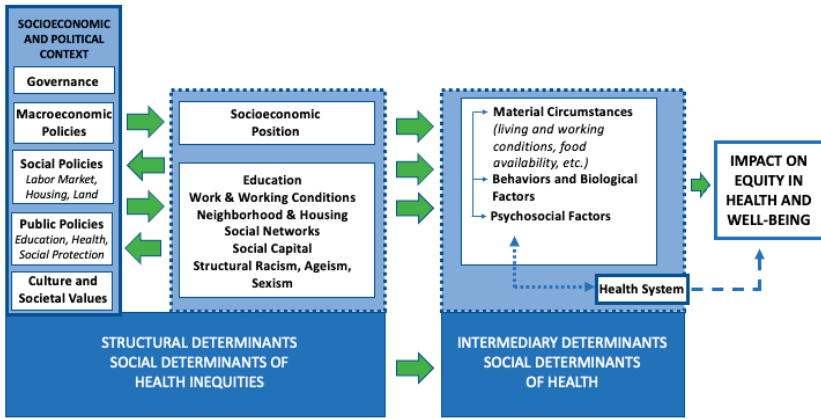
FIGURE 4-2 Conceptual framework for structural and social determinants of health.
SOURCE: Adapted from *A conceptual framework for action on the social determinants of health*, Solar and Irwin, 2010.

Impacts of Poverty and Inequality on Life Expectancy

Recent research illustrates the critical importance of certain social determinants for achieving healthy longevity. Life expectancy follows a social gradient, whereby the more deprived an area, the shorter the life expectancy of its population (Marmot, 2020). "Neighborhood deprivation, measured as the proportion of residents with low income, low education, and being unemployed," is one indication of concentrated inequalities (Bender et al., 2015, p. 2). Researchers studied the effects of neighborhood characteristics in the United States on six common chronic conditions—hypertension, heart problems, stroke, diabetes, cancer, and arthritis. They found that "women living in disadvantaged neighborhoods were more likely than other women to develop heart disease, even after controlling for individual characteristics and aspects of the physical environment (e.g., population density, pollution, walkability)" (Freedman et al., 2011, p. 83). As inequality has persisted, this social gradient has become steeper, and disparities in life expectancy have increased. This is the case in all countries, regardless of income level. For example, a recent review examined life expectancy disparities across regions in England. The study found that for both men and women, life expectancy was lower in the most deprived areas and higher in the least deprived areas. The researchers surmise that "social and economic conditions have undermined health" (Marmot, 2020, p. 10) such that "people living in more deprived areas spend more of their shorter lives in ill health relative to those in less deprived areas" (p. 3).

The United States also has geographic disparities in life expectancy among counties that have increased over the past 35 years (Chetty et al., 2016). Socio-

economic, race, and ethnicity factors alone now explain 60 percent of U.S. life expectancy (Dwyer-Lindgren et al., 2017). Improvements in life expectancy at age 50 in majority Black counties lag nearly 30 years behind counties where fewer than 5 percent of residents are Black (Tan, 2020). "The US reduction in 2020 life expectancy is projected to exceed that of most other high-income countries, indicating that the United States—which already had a life expectancy below that of all other high-income developed nations prior to the pandemic— will see its life expectancy fall even farther behind its peers" (Andrasfay and Goldman, 2021, p. 3). Given the numerous disparities in health and wealth, it is not surprising that declines in life expectancy in the United States are not evenly distributed. Andrasfay and Goldman (2021) estimate that, among Black and Latinx populations, the pandemic will result in life expectancy reductions three to four times greater than reductions among White populations. "[T]he dispro-portionate burden of death in Black and Latino populations reflect the underlying social disparities that have been documented for decades and amplified during the current pandemic," demonstrating that social factors are at the root of gross inequalities in health outcomes (Andrasfay and Goldman, 2021, p. 4).

In all countries around the world, growing levels of inequality—measured as the difference between a country's gross domestic product (GDP) and the distribution of wealth (i.e., the net worth of a person) or income (i.e., the amount of money a person receives on a regular basis) within its population—threaten the achievement of equitable healthy longevity. In 2020, the United Nations' (UN's) *World Social Report* showed increasing income inequality for more than 70 percent of the global population, which hampers economic development in a country (UN, 2020b). Additionally, in 2021, the World Economic Forum noted that, although income inequality among countries has decreased over the past decades, the income inequality within countries has actually increased (Myers, 2021). Gaps in wealth inequality are even higher.

"While in general a country's life expectancy increases with national in-come, some countries … achiev[e] higher or lower life expectancy than would be predicted by their per capita income" (Freeman et al., 2020, p. 1). An analysis of Brazil, Ethiopia, and the United States found that Ethiopia had 3 more years of life expectancy than anticipated based on its GDP per capita, and Brazil had 2 more years (Freeman et al., 2020). The researchers attributed the extra 3 years of life expectancy in Ethiopia to "community-based health strategies, improving access to safe water, female education and gender empowerment, and the rise of civil society organisations" (Freeman et al., 2020, p. 1). Conversely, life expec-tancy in the United States was 2.9 years lower than expected, based on GDP per capita, demonstrating that a country's national income alone does not dictate life expectancy. Countries can take steps to address identified factors to reduce levels of inequality among residents.

Alignment with the Sustainable Development Goals

Substantial crossover exists between the social and physical environment enablers of healthy longevity and the UN Sustainable Development Goals (SDGs) (outlined in Chapter 2). Countries that strengthen institutional structures to improve healthy longevity will also make progress toward attaining the SDGs. Globally, realizing healthy longevity will require progress on the SDGs of eliminating poverty in older age (SDG 1), ensuring gender equality across the life course (SDG 5), promoting decent work for people of all ages (SDG 8), reducing inequalities and ending discrimination in later life (SDG 10), and building inclusive and accessible communities (SDG 11).

"While action on SDGs is likely to affect health and health equity either directly or indirectly, the effects on inequalities in SDOH will need to be assessed and monitored" (Marmot and Bell, 2018, p. 6). To this end, the implementation of actions to attain the SDGs will need to cut across traditional silos, with attention paid to how action on one goal can impact goals in other areas so governments and other stakeholders can maximize cobenefits. Thus, to collectively accelerate progress toward the SDGs, it will be important to find ways to work across sectors and ensure that action in one sector does not adversely affect others.

> Finding 4-1: The social determinants of health have enormous consequences that can influence people's ability to achieve healthy longevity.

> *Conclusion 4-1: In designing and implementing policies to promote healthy longevity, it will be essential to acknowledge the cumulative effects of social determinants of health across the life course. With equity at the core of these policies, governments can address the historical and structural inequalities that have translated into a poor baseline of health for some populations as they enter the second half of life.*

THE SOCIAL CAPITAL OF OLDER ADULTS

Beyond SDOH, social connections are important drivers of health and well-being. The importance of social engagement to healthy longevity at both the individual and societal levels cannot be overstated. Figure 1-4 in Chapter 1 outlines the key enablers and disruptors of healthy longevity, and illustrates how social engagement can work with other enablers to influence a person's health trajectory. People grow old within social networks of family members, friends, and others with a set of assumptions, expectations, and beliefs that shape their experience of aging. Societal perceptions of what it means to have a fulfilled, successful, or dignified life are diverse, and they change over time, but in all cultures,

social contexts, and countries, community institutions have a role in providing meaningful opportunities in which older adults can participate.

Social capital has been defined as "the connections among individuals, social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000, p. 19). The more recent literature suggests a new definition of social cohesion as "the ongoing process of developing well-being, sense of belonging, and voluntary social participation of the members of society, while developing communities that tolerate and promote a multiplicity of values and cultures, and granting at the same time equal rights and opportunities in society" (Fonseca et al., 2019, p. 246). The absence or decline of social cohesion can also be thought of as social erosion, with fewer citizens believing they are part of a moral community and having trust in one another (Larsen, 2014).

While a strong fabric of social cohesion provides many benefits to a community, one positive consequence is increased capacity for collective efficacy, with such outcomes as less conflict and violence in the community and increased formation of self-help enterprises, and a virtuous cycle from these benefits to improved bridging and bonding social capital. Social capital in communities has been found to have a "buffering" effect that counters the more adverse factors. For example, one study found that Hispanics and foreign-born citizens in the United States have a longer life expectancy than native-born non-Hispanics, which the authors attribute to strong social connections despite lower income levels (Singer et al., 2017). Social capital has also been noted as a key factor in resilience to and recovery from disasters. Following the Nepal earthquake in 2015, for example, researchers found that "high levels of bonding and bridging capital among residents reduced barriers to collective action" and assisted in rescue and recovery efforts (Panday et al., 2021). In the context of aging populations, the development of these connections across generations can be described as intergenerational cohesion, which can also have numerous advantages for families and societies. The United Nations recognizes intergenerational cohesion as essential to healthy societies (Butts et al., 2012).

Older adults have the capability to play a significant role in improving social cohesion both within and across generations, as well as increasing social capital, although opportunities to benefit from this capability have thus far been largely untapped. In the commission's vision for healthy longevity (see Chapter 2), maintaining health into the second half of life will enable older people to remain engaged in their communities. With the right structures, older people could bring decades of accumulated knowledge and experience to the community and help younger people achieve success as they enter the workforce. Older people also provide care for grandchildren. The positive dimensions of aging and corresponding benefits to society can create social and human capital that can help address unmet needs and increase societal well-being (Fried, 2016). Social capital can be strategically and intentionally built, for example, by helping people who want to

work at later ages remain in the workforce and creating volunteer opportunities, as described in Chapter 3.

KEY TARGET: PROSOCIAL STRENGTHS OF OLDER PEOPLE

Being embedded in a larger social group holds powerful evolutionary advantages because humans are social beings. However, the nature of social networks changes with age. Abundant evidence demonstrates positive developmental trends in social and emotional functioning as people age, including evidence that older people are more prosocial than younger people. Prosocial behaviors are actions that benefit others (Cutler et al., 2021).

Quality relationships with families, kinship and friendship networks, and community ties, as well as the impact of social ties on health, remain important to well-being throughout the life course (Umberson et al., 2010). Evidence suggests that social networks narrow as people age (Lang and Carstensen, 2002). However, longitudinal findings suggest that the narrowing of social networks begins long before old age, which means it is not attributable to causes specific to aging (English and Carstensen, 2014). On the contrary, networks narrow selectively, such that people retain emotionally close social partners while eliminating more peripheral ones.

The current literature on social and emotional aging documents numerous positive trends in socioemotional functioning that contrast with stereotypes. Older people are more emotionally stable than their younger counterparts and often enjoy more positive emotional functioning in daily life (Carstensen and Chi, 2021; Carstensen et al., 2011). Notably, these emotional advantages were evident even during the COVID-19 pandemic, and studies validating this advantage of age during the pandemic have been replicated in scores of countries (Sun and Sauter, 2021). While aging is often associated with declines in cognitive function, a recent study found that social cognitive abilities and prosocial learning were more pronounced in older adults compared to those under age 36 (Cutler et al., 2021). Lack of concern for others was also found to be lower among older adults. Compared with younger and middle-aged people, moreover, older people experience fewer negative emotions in everyday life (Carstensen et al., 2011). They also express more gratitude, which in turn has been positively associated with physical and mental health (Emmons et al., 2003; Kubzansky et al., 2018). This evidence should inspire those in power to aim beyond simply addressing problems of vulnerable older people to work to build systems that leverage the social capital that increasing numbers of older and healthier people will bring to society.

Prevalent stereotypes of older people as regularly frail, burdensome, and dependent limit society's ability to appreciate and capitalize on their potential human and social resources, which in turn undermines intergenerational cohesion and solidarity and threatens the achievement of inclusive, just societies

(WHO, 2020). Efforts to foster social connections and build cohesion start in local communities, where informal caring for family members, neighbors, and acquaintances is the norm.

> Finding 4-2: Advancing age is associated with increased motivation to contribute to other people, younger generations, society, and the greater good. In addition, older people's experience, knowledge, and emotional stability hold the potential to build the social and human capital needed to create and perpetuate healthy longevity.

> *Conclusion 4-2: Societies with healthy longevity can capitalize on the emotional stability and prosocial strengths of older people by enabling them in their existing roles and emerging new roles.*

KEY TARGET: AGEISM AND AGE DISCRIMINATION

One of the most significant barriers to achieving healthy longevity is ageism. Ageism encompasses systemic stereotypes and prejudice, whether directed toward others or oneself—even many older people believe age-based stereotypes. Ageism can occur at the interpersonal level, between individuals; at the social level; or at the structural or institutional level (Marques et al., 2020). Because every person who lives to an advanced age will experience ageism, its scope and breadth are massive. In the European Social Survey, age discrimination was the most frequently reported form of discrimination for every age group. Among European countries, reports of unfair treatment of older people ranged from 17 percent (in Portugal and Cyprus) to 54 percent (in the Czech Republic), with an average of 35 percent (Ayalon, 2014). The COVID-19 pandemic has made ageist attitudes even more entrenched (see Appendix B). Structural ageism can also be found across sectors, including entertainment, marketing, social media, the workplace, and health care (Levy, 2022). Yet despite the scale of its negative impacts on older people and societies, "ageism remains a neglected global health issue" (Officer et al., 2020, p. 1).

Ageism is grounded in the belief that older people are fundamentally different from younger people. However, the old and the young actually have much in common; they work in the same jobs, maintain households, and participate in society. Media and advertising characterizations reinforce negative attitudes and biases toward older people. A 2019 AARP study found that adults over age 50 "represent only 15 percent of adults in online media images, and are seven times more likely to be portrayed negatively," relative to younger adults (Dychtwald, 2021). Commonly held ageist attitudes are embodied in laws, policies, and institutions—particularly those related to health, social, and legal systems. When left unchecked, they can impede progress toward healthy longevity.

Older people experience the deleterious effects of ageism most directly. Once they are perceived as an "older adult," they are exposed to external stereotyping and discrimination, as well as internalized ageist attitudes that are unconscious self-stereotypes. Worse health outcomes are seen among those exposed to ageism, including weaker and more negative social expectations of older generations, and internalization of ageist attitudes is "significantly associated with poorer physical and mental health in older adults" (Officer et al., 2020, p. 2). Accumulating evidence is also linking structural ageism to adverse health outcomes. According to a systematic review, 85 percent of 149 studies found that clinicians were less likely to offer treatments to older versus younger patients even if those treatments offered equal benefit regardless of age (Chang et al., 2020). At the same time, however, young people are not immune from discrimination. While more data are needed, attitudes toward younger people in Europe are more negative than attitudes toward older people (WHO, 2021a). Younger people are more likely than those in other age groups to report that they have been the victim of age-based discrimination. As evidence on cumulative exposures across the life course continues to demonstrate the importance of discrimination, it becomes clear that this is an area in need of greater attention.

In addition to its enormous burden in the area of health and well-being, ageism has substantial economic impact, costing countries billions of dollars annually (WHO, 2021a). One study found that negative age stereotypes, negative self-perceptions, and age discrimination in the United States led to estimated annual costs of USD63 billion for the top eight most expensive health conditions, and in Australia, estimates suggest the national economy would realize an additional AUD48 billion annually if 5 percent more people aged 55 or older were employed (WHO, 2021a). As discussed in Chapter 3, ageism is also a factor in decreased labor force participation among older people.

Compounded Discrimination

Ageism can interact with other forms of bias and exacerbate or compound the disadvantages they cause, greatly affecting an individual's health and well-being (WHO, 2021a). A growing number of studies have explored the intersections between ageism and different forms of discrimination, including racism, sexism, ableism,[2] heterosexism, classism, xenophobia, and others. Ageism and ableism, and ageism and sexism are two examples of multiple, compound, and intersectional discrimination that are especially pervasive.

Women constitute the majority of the older population around the world, but they often remain invisible to policy makers. Yet, they face unique ageism challenges that need to be accounted for in the global response to aging. In countries

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[2] Ableism is discrimination or prejudice against people with disabilities.

at all income levels, lifetimes of marginalization and discrimination, including unequal and inadequate access to education and jobs, compound the effects of ageism for women.

Women are more likely than men to engage in informal sectors of the economy and to perform unpaid work, such as caring for children and family members with disabilities and performing household work. Older African women, for example, contribute substantial amounts of unpaid domestic and care work, and often perform this type of work for longer relative to women in other regions/countries (He et al., 2020). In Latin America, for example,

> [t]he overload of unpaid care work and the time-poverty that women face prevent equality of opportunity, rights, and outcome relative to men regarding participation in the labour market, but also social and political participation, and in the enjoyment of free time. Ultimately, the overload of this type of work on women limits their opportunities and stands in the way of their economic empowerment and also in the way of the possibility to enjoy their rights on an equal footing with men. (UN, 2020a, p. 7)

Although many older women contribute substantially to national economies, their lower rate of participation in the paid workforce across adulthood has cumulative negative consequences, including greater risk of poverty due to limited access to or low pensions (Bonnet et al., 2019). The caregiving burden often borne by women is exacerbated in such crisis situations as war, famine, forced migration, and epidemics or pandemics. Older women are negatively affected in these situations if they are not economically empowered because they rely heavily on the support of younger adults. To combat inequality, it will be essential to address the root causes and intersection of such prejudices as ageism and sexism. An example from Lebanon focuses on the engagement and empowerment of older women (see Box 4-1).

BOX 4-1
Providing a Platform for Older Women to Voice Concerns

Following the Beirut port explosion, large numbers of older women who lived alone in affected areas were unable to leave their homes and had difficulty accessing assistance. As a high-risk group, older women especially become increasingly vulnerable to neglect, isolation, poverty, and food insecurity and required tailored assistance to meet their needs. In 2021, the United Nations and Women's Peace and Humanitarian Fund launched a fund to support women's rights organizations in Lebanon, with the goal of enhancing women's participation in the Beirut port explosion response and recovery process.

continued

BOX 4-1 Continued

Six grassroots organizations uplifted women's voices by providing a platform for them to express their concerns, to be included in the decision-making processes, and to contribute to the establishment of national recovery plans that would be inclusive of all marginalized groups. Madaniyat, a Lebanese nongovernmental organization that works to create a more inclusive political system in Lebanon, also addressed the current marginalization of women, especially older women, with respect to participation in humanitarian efforts undertaken by municipalities and stakeholders. Supporting women activists of all ages, creating opportunities for engagement and ensuring that their voices are heard, and providing them with the tools needed to thrive are important steps in transcending gender- and age-based discrimination.

SOURCES: UN Women, 2021; UN Women et al., 2020.

Interventions for Combating Ageism

A recent meta-analysis suggests that "relatively low-cost, feasible strategies involving education and intergenerational contact can serve as the basis of effective interventions to prevent ageism" and address the digital divide that keeps many older adults from using technology (Burnes et al., 2019, p. e1). In Australia, The Benevolent Society has conducted focus group discussions that have highlighted the importance of older people using their voice to combat ageism by participating in discussions regarding societal constructs of retirement ages and providing counter information and opportunities for other older people to reflect on their own internalized biases and ageism (Every Age Counts, 2017). In addition to educational campaigns, laws and policies can bring some needed strength to the importance of reducing and preventing age discrimination. As an example, the Organization of American States drafted the Inter-American Convention on the Protection of the Human Rights of Older Persons (OAS, 2017). It underscores that "older persons have the same human rights and freedoms as other persons," which include the right not to be subjected to age-based discrimination or violence (OAS, 2017). Signatories agreed to accomplish this by adopting measures such as eradicating isolation, overcrowding, and food or medical treatment deprivation, and adopting or strengthening legislative or administrative measures to ensure adequate access to justice.

While some may assume that international frameworks such as the *Universal Declaration of Human Rights* (UN General Assembly, 1948) guarantee basic human rights to older people, ageism persists and is a violation of those rights. As is, the Declaration does not go far enough to address age discrimination against older people, and the rights of older people often remain invisible (Mokhiber,

2018). Even documents such as the *Madrid Plan of Action* are not legally binding and ask governments for commitments, so many are calling for a UN Convention on the Rights of Older People to combat ageism, clarify responsibilities, improve accountability, and guide policy making (UN, 2010).

Recognition of ageism as an SDOH could also help eliminate it (WHO, 2020). For example, WHO Africa and HelpAge International have organized a regional campaign to raise awareness of the magnitude and impact of ageism. The main objective is to strengthen the capacity of African countries by sharing resources and tools to establish a community of young advocates who work to change the narrative around aging (WHO Africa, 2021). Interventions that include both education and intergenerational contact demonstrate especially strong effects, especially for combating negative attitudes toward and perceptions of aging (see Box 4-2).

BOX 4-2
Strategies for Combating Ageism: Public Awareness
Campaigns and Intergenerational Contact Interventions

The World Health Organization's (WHO's) *Global Report on Ageism* outlines two strategies for reducing ageism by dispelling misconceptions about older adults and fostering interaction between different age groups: public awareness campaigns and intergenerational contact interventions, respectively. Public awareness campaigns are most effective in combating ageism when they provide accurate information about older adults and counter stereotypical examples that allow people and organizations to reconsider and update their beliefs. Intergenerational contact interventions combat ageism by providing a platform for different age groups to build meaningful relationships. For older adults, these interventions can lead to improved health and psychological well-being by decreasing loneliness and increasing sense of purpose. The two examples below illustrate these approaches.

Changing the Narrative Colorado Campaign: Ending Ageism Together Through Everyday Activism

Changing the Narrative Colorado has trained advocates, policy makers, and other influencers in the use of evidence-based communication tools to reframe aging positively and highlight the strengths and talents of older adults. Its Age-Friendly Workplace Initiative works with organizations to help them become Certified Age-Friendly Employers. These organizations then invest in training for people of all ages, remove age identifiers from applications, and encourage mentoring across generations in the workplace. Additionally, the initiative assists job seekers over the age of 50 by identifying age-friendly employers that value the strengths of older adults. Employers benefit by expanding the skill sets of their employees and supporting the workforce, while older employees engage in meaningful development opportunities.

BOX 4-2 Continued

Age Nigeria Foundation: Help Unite Great Generations in Nigeria (HUGGING)

The Age Nigeria Foundation works with international partners in Nigerian communities to campaign against ageism and provide critical assistance for older adults who have trouble accessing care, housing, and transportation. Recent intergenerational programs brought together older adults and young students to honor the importance of intergenerational cohesion and respect for all age groups. Lectures included information about ageist policies, ways to support older adults in communities, and possible interventions for creating meaningful relationships across generations.

SOURCES: Changing the Narrative, 2021; HelpAge International, 2016a; WHO, 2021a.

Levers for Empowering Change

Overcoming ageism will require societies and individuals to change the way they think, feel, and act toward age and aging (WHO, 2021a). It will also require dual approaches to reducing and preventing further ageism at both the individual and structural levels. Educational efforts can help more people see the value of older adults and change stereotypes, but different solutions will be required to change the more structural biases embedded in institutions such as health care and the workplace. Addressing this key target is a complex and multifaceted challenge that will require long-term attention. But the actions called for in this report align with other expert reports calling attention to similar needs and approaches. For example, the WHO *Decade of Healthy Ageing* (2020) report also emphasizes the need to change how people think and feel about aging (reducing ageism), calling on member states to adopt legislation banning age-based discrimination and supporting the development of programs to reduce and eliminate ageism in several sectors.

Finding 4-3: Ageism is a barrier to achieving healthy longevity across all countries and cultures, especially when compounded with other forms of discrimination, such as sexism or racism.

Finding 4-4: Countries have initiated successful programs to combat ageism by creating a culture with positive expectations of and about older people to improve the well-being and productivity of people as they age.

Conclusion 4-3: Greater attention to the prevalence and pervasiveness of ageism in all sectors is warranted. Combating ageism will require

a range of responses, from eliminating ageist laws, regulations, and policies; to ending discrimination based on age; to modifying cultural attitudes about older people's capacities. Public information campaigns can promote the value of older people and attack stereotypes, while advocacy efforts can bring generations together to fight discrimination and recognize ageism as an essential element of efforts directed at diversity, equity, and inclusion.

Recommendation 4-1: Governments should develop evidence-based, multipronged strategies for reducing ageism against any age group by

a. **collaborating across sectors—for example with local governments, industry, and nongovernmental organizations (NGOs)—to launch public information campaigns that highlight the value of older people to society;**

b. **developing public and private partnerships to create programs, connected intergenerational communities, and innovative models that enable all people to contribute to society; and**

c. **developing legal protections for the rights of older people and ending age-based segregation and discrimination (e.g., legal barriers related to housing, policies that discourage work at older ages).**

Metrics

While there must be a careful balance between prioritizing existing and validated metrics and being open to different ideas in evaluating policies and programs based on a range of outcomes, there is utility in tracking indicators related to the reduction of ageism. The WHO *Decade of Healthy Ageing* (2020) report also highlights indicators related to the SDGs but modified to track the progress of older adults specifically. For example, specific to this key target of combating ageism, WHO recommends (WHO, 2020)

- Indicator 10.3.1: Proportion of population who reported personal discrimination or harassment in the previous 12 months on the basis of grounds of discrimination (age) that are prohibited under international human rights law.

Research Questions

While many recommendations and metrics have been released in recent years as this topic has grown in importance, many interventions still lack solid evidence, and questions remain about how best to prioritize resources and populations. Following a literature review conducted in the United Kingdom, researchers at the University of Birmingham noted the paucity of research on how aging is experienced by different cultural groups (Field and Fenton, 2014).

Because data are limited, WHO suggests the need for research "producing estimates of the economic impacts of ageism and determining how ageism contributes to poverty among older people, its wider costs to national economies, and how ageism contributes to slowing social and economic development, particularly in low- and middle-income countries" (WHO, 2021a, p. 57). Additionally, the effectiveness of laws and regulations in addressing ageism has been demonstrated, but there is a need to expand the evidence base in low- and middle-income countries, and more robust systematic reviews are needed to determine the strength of various interventions (WHO, 2021a). While intergenerational cohesion is discussed further in the next section, there is a need for "research to determine the optimal conditions under which contact between grandparents and grandchildren and intergenerational friendships lead to reductions in ageism" and "development and testing of interventions to foster these relationships and reduce ageism" (WHO, 2021a, p. 134). Finally, knowledge is insufficient on the scale and impact of ageism directed at younger populations. Although this report focuses mainly on older adults, given the high proportion of young people in many countries and extended life expectancies, understanding these interactions and potential discrimination that occurs between generations is another opportunity for greater insight.

KEY TARGET: SOCIAL INCLUSION

Isolation is defined as the experience of being alone (a state of objective physical separation), while loneliness refers to perceived isolation and lack of satisfying emotional connections to others. Humans are not meant to survive alone. The perception of isolation and feelings of loneliness have negative consequences for socioemotional and physical health and are risk factors for disease and early death (NASEM, 2020). Loneliness is often associated with old age but has been increasing in people of all ages in recent decades. Research has found that loneliness levels actually peak before the age of 30, then diminish through middle adulthood into early stages of old age. After a person turns 80, reported loneliness begins to increase again, to levels comparable to those of younger people (Luhmann and Hawkley, 2016). Thus, while it is wrong to assume that older people as a group are lonely, a significant minority do report loneliness. The challenge is worldwide, with an estimated 20–34 percent of older adults in China, Europe, Latin America, and the United States identifying themselves as being lonely (WHO, 2021b).

Aside from emotional impacts, loneliness is associated with poor health outcomes including depression, dementia, heart disease, and other conditions (Singer, 2018). The combined neurobiological effects of loneliness on sleep, executive functioning, and mental and physical well-being contribute to higher rates of morbidity and mortality in older adults (Cacioppo and Hawkley, 2014). The costs of social isolation and loneliness are only beginning to be fully appreciated. In the United States, for example, social isolation adds an estimated USD6.7 bil-

lion to Medicare spending annually (Flowers et al., 2017). In many high-income countries experiencing historically low birth rates and longer lives, increasing numbers of older people are living alone without other family members, raising concern that loneliness may be more prevalent in the future.

Cultural and social factors across the life span can affect a person's ability to achieve healthy longevity. As discussed earlier in this chapter, social capital and social cohesion can be particularly influential toward building strong communities and keeping adults engaged as they age. But ongoing demographic changes will require greater attention to minimizing age segregation and ensuring ongoing social connection, which can help combat loneliness. Some potential mechanisms to this end include leveraging religious and spiritual connections, empowering older adults within communities, and creating opportunities for intergenerational connections and cohesion. Societies can support these and other intergenerational programs to promote healthy longevity.

> Finding 4-5: Older people have lower rates of loneliness relative to younger people, but rates begin to rise again after age 80. When paired with the increasing prevalence of chronic conditions as people age, this rise in loneliness can contribute to several comorbidities affecting healthy longevity.

Leveraging Religious and Spiritual Connections

Healthy aging is positively associated with religiosity and spirituality. As people age, they can be more likely to consider spiritual questions with greater importance to and influence on their lives. There is evidence of positive correlations "between self-forgiveness, spiritually motivated forgiveness, and psychosocial well-being" (Banerjee, 2021, p. 66). While spirituality can be an abstract concept, there are numerous practical manifestations, such as gratitude, meditation, forgiveness, sense of purpose, and volunteering (Banerjee, 2021). There are also benefits to a formal religious community. Focus groups in the United Kingdom, for example, identified as a theme the sense of community and belonging gained through participating together and related social activities such as sharing meals (Malone and Dadswell, 2018). Drawing on these roles and understanding the importance of religion and spirituality in the lives of older adults can help inform the discourse on healthy longevity.

Identifying these connections can also provide linkages across generations and help promote healthy longevity across the life course. A systematic review examined the effect of spirituality and religiousness as a predictor of quality of life for young people and overwhelmingly found positive associations (Borges et al., 2021). The most predictive factor for good quality of life was the spirituality the participants adopted—components such as hope, optimism, inner peace, and faith—even without a formal religious affiliation. Researchers also found positive effects on mental health. Across studies, positive influences of religion

and spirituality on quality of life and healthy longevity were noted, despite the heterogeneity in how people come together to worship and what the various settings look like.

Empowering Communities and Engaging Older Voices

Fostering social inclusion in communities requires creativity when government resources are stretched and populations are aging rapidly. Overall, fostering community advocacy and seeking the voice of older people are valuable policy goals that could complement the more traditional roles of advocacy for prevention of abuse of older people (Field and Fenton, 2014). Biological age cutoffs are not useful markers for understanding the needs of older people, and having a more nuanced understanding of aging across the life course would provide additional insight. One approach to engaging older people is through participatory design, ideally to bring underrepresented groups and minorities into the decision-making process that directly affects them, which differs from the traditional top-down decision-making model. A study in New Zealand with the Maori community summarizes steps in that community's approach as "(1) understanding of place, (2) relationship building, (3) respectful facilitation, and (4) empowered participation" (Marques et al., 2018, p. 6). Using a collaborative approach in seeking feedback and informing the design of programs and policies can result in greater sustainability and social benefits because the results acknowledge that different people can experience different realities.

Without an opportunity for the voices of older adults to be heard and incorporated into community and urban development, it will be impossible to truly meet their needs and optimize the environment for healthy aging across the life course. Engaging people in their own community development is more important than ever today, given the rate of population aging and the availability of older adults as an underutilized resource (HelpAge International, 2016b). Community-level interventions are effective and can lead to improved earning, healthier residents, and more active participants in the community. In Taketoyo, Japan, for example, the implementation of community-based centers, or "salons," where senior residents could gather showed a protective association against cognitive decline among those over 65 who participated (Hikichi et al., 2017).

Each region and country will have its own methods for incorporating the voices of older adults, but the Older People's Associations (OPAs) found throughout Asia are a good example. A four-country study conducted in 2017 found that OPAs can make a true difference in the lives of older people, and can be used to develop local structures to fill the gaps between families in need of assistance and governments with limited resources (Howse, 2017). Keys to success for an OPA include strong management, sustained funding, and active and engaged members (HelpAge International, 2016b). Box 4-3 highlights a pilot project in Vietnam that promotes healthy longevity through a variety of community-driven activities and interventions.

BOX 4-3
The Intergenerational Self-Help Club Development Model

Vietnam is predicted to be one of the most rapidly aging countries in Asia, with the ratio of adults over 65 doubling over the next two decades; thus, there is a clear need to address the social, health, and economic implications in the country. Additionally concerning is that Vietnam has limited resources to respond to these changes and lacks a long-term care system.

To address these challenges, with funding from the World Bank and the government of Japan, HelpAge International in Vietnam and local community partners launched a project in September 2021 to scale the Intergenerational Self-Help Club (ISHC) model they had previously developed. Their goals are to scale up the ISHC network and promote healthy, social, and active aging in their communities. One key activity is expanding the network through the creation of 180 additional self-managed ISHCs. The club provides a range of intergenerational activities to help members with generating income, improving physical and mental well-being, and understanding their rights. Club members also volunteer to provide services to homebound community members.

The model is a comprehensive and inclusive approach that promotes psycho-social health, lifelong learning, and physical health via regular meetings, activities, and health screenings. The ISHCs also promote self-reliance through self-managed microcredit mechanisms and offer legal services and support.

According to the Asia Health and Wellbeing Initiative, the impact of the project has been widespread, with most members reporting feeling happier, wealthier, and healthier, as well as more empowered. They attribute these successes to the community-driven approach guiding each ISHC to be customized to the needs of the community, the holistic approach allowing response to multiple needs of older people, and assistance from local partners.

SOURCES: Asia Health and Wellbeing Initiative, 2020; World Bank, 2021.

Intergenerational Cohesion

Globally, economic security, social norms, and cultural values form ties within communities composed of families, kinship groups, and nonfamilial groups. When these ties are robust, with opportunities for interaction among different subpopulations, such as intergenerational social networks, cohesion is strong, and loneliness is less likely. Intergenerational social networks differ among countries and regions, but the dominant norms emphasize the importance of intergenerational connections and the protection they can provide against social isolation and loneliness. Importantly, benefits are seen across generations, not just among older adults.

Intergenerational programs have been developed by the public and private sectors. Although their effectiveness and optimal parameters are still being refined, benefits are widely reported for such programs. Older adults in these programs become less isolated and feel less lonely, and experience improved health

and well-being (Jayson, 2018). Older adults with dementia experience positive effects and increased engagement when interacting with children when compared to activities that do not mix generations. Benefits accrue to the children in these programs as well, including improved learning and social development and more positive perceptions of older adults (United for All Ages, 2018). To generate these benefits, some organizations have created intergenerational play programs or classrooms designed to bring disparate age groups together. In the United States, for example, the St. Ann Center in Wisconsin specializes in adult and child day care services that include an intergenerational activity or class twice a day that provides an opportunity for the groups to interact and learn from one another (St. Ann Center, 2021). A systematic review of intergenerational programs examining benefits for children and older adults found improvements in attitude, behavior, confidence, and competence for the children, along with "significant differences in mental and physical health and quality of life for the older adults" (Giraudeau and Bailly, 2019, p. 363). However, the design and implementation of these programs is key to their success, and benefits will not be automatic.

Another approach to building intergenerational connection is illustrated by the Cycling Without Age program, started in Denmark in 2012 (Cycling Without Age, 2021). Limited mobility was preventing older adults from riding bicycles, so the program obtained "trishaws" that seat two people in front and the cyclist (usually a younger person) behind. The program gives older people an opportunity to remain an active part of society and the local community while also creating new relationships between generations. Younger people volunteer to drive the older riders and have the opportunity to hear stories from them before those stories are forgotten. The program currently has 2,700 chapters in 52 countries.

Another mechanism for building or maintaining strong connections across generations, directly and indirectly, is through multigenerational households that pair either older and younger generations or families. An increasing number of innovative examples of such arrangements have emerged worldwide as housing has become a shrinking, desirable commodity and older adults strive to age in place. Critical evaluations of these arrangements are often lacking, and because of variability in cultures and contexts, what works in some places may not work in others. Nonetheless, drawing lessons from successful interventions involving multigenerational households can guide the future development of such programs. In the Netherlands, for example, experiments in which college students live with older people began in 2012. This quite successful housing scheme, often dubbed "free rent for companionship," provides students free housing in exchange for 30 hours per month of their time spent with their older housemates (*The Economist*, 2019a). Similarly, a study in France found that intergenerational housing arrangements solved two pervasive problems in the city of Paris: caring for older adults and providing affordable housing (Holman, 2019). 61 percent of people aged 18–30 living in one of these arrangements said they would not have had access to traditional housing otherwise, and more than half of the older

adults reported that having a young person living with them allowed them to delay moving into a retirement home.

Adults of all ages are at risk of social isolation and shrinking family ties as a result of global trends toward smaller families and employment-related migration (Cacioppo and Hawkley, 2003). While families have varying reasons for multigenerational living, they often go beyond a desire for connection, reflecting structural pressures and individual circumstances, such as affordability, divorce, or illness, that make these arrangements the most practical option (Burgess and Muir, 2020). Among rural dwellers in Myanmar, for example, close proximity or coresidence of older people and their adult children's families provides personal material support and services (Knodel and Teerawichitchainan, 2017). Multigenerational living offers other benefits aside from potential financial savings. In one study, healthy subjects in the United States who lived in two-generation housing had lower premature mortality than those who did not (Muennig et al., 2018). And researchers in China found that men and women who lived in an institution or moved to such a facility after living with family faced a greater risk of dying relative to those who continued living with family (Feng et al., 2017).

Living arrangements are highly variable depending on culture and region. In North America and Europe, one in five older adults live alone (UN, 2019a), while in Asia, Africa, and Latin America and the Caribbean, more than 75 percent of older people live with children or extended family (Kamiya and Hertog, 2020). Evidence suggests, however, that these numbers may be shifting. A recent study found that multigenerational living is on the rise in the United States: one in four Americans now live in a household with three or more generations, representing a four-fold increase in multigenerational households in the past decade (Generations United, 2021). Box 4-4 describes a variety of influences and factors that may be at work in shaping intergenerational households in different countries.

BOX 4-4
Explorations in Intergenerational Living

In **Kenya** for many years, older adults have become caregivers for their grandchildren who have suffered the loss of a parent due to HIV/AIDS. Minimal financial assistance is available for these caregivers, as many older adults in Kenya are not enrolled in pension plans. In addition, older adults generally lack basic knowledge of immunization schedules, education requirements, and child development. Recently, however, caregiving for grandchildren has been recognized as such a common role that Article 12 of Africa's *Protocol to the African Charter on the Rights of Older Persons* states that "parties shall adopt measures to ensure that older persons who take care of orphans and vulnerable children are provided with financial support" (African Union, 2016).

continued

BOX 4-4 Continued

In **India**, joint family systems are very common. Grandparents are valued members of the family and contribute to household work and child care. In rural areas, older adults who are educated and want to remain involved in the community have started offering classes for poor children who cannot afford to attend school or daycare facilities.

In **Lebanon**, as more women entered the workforce, grandparents became caregivers for their grandchildren, often taking on administrative duties such as managing bank accounts within their multigenerational family. This type of caregiving is decreasing, however, as multigenerational households decrease in number and young adult children live independently with their children.

To avoid building more nursing homes, **Singapore** has created incentives for families to live in multigenerational housing units. Interest in these arrangements has declined over time, however. Conversely, in **Thailand** and **Japan**, a high value is placed on older adults' role as caregivers, as evidenced by high rates of coresidency, with 80–90 percent of older adults living with their adult children. However, these rates are beginning to decrease as younger generations push for independence.

SOURCE: Evidence gathered from National Academy of Medicine Healthy Longevity Roadmap Regional Interviews in August–September 2021. More information found in Appendix C.

Levers for Empowering Change

Lack of social inclusion can impede healthy longevity. Efforts to address loneliness and intergenerational cohesion can help promote social inclusion in communities and serve as entry points for addressing other needs, including housing, food, and transportation. Cities and communities are increasingly creating programs to connect people across generational gaps, recognizing the benefits for all participants. Given the high levels of loneliness reported by younger adults, bringing age groups together can yield benefits for both older and younger people. Research and evaluation of existing programs will be needed to develop a clear understanding of the best such interventions in specific contexts. Countries and communities will need to monitor the effects of changing dynamics as younger families opt to live separately from older generations or move to other parts of the country for work. In the face of such changes, it will be important to maintain, encourage, and support social roles for older adults.

Finding 4-6: Intergenerational programs globally provide diverse opportunities to address loneliness at all ages, with the potential to achieve improvements in other targets, such as reducing ageism.

Finding 4-7: While intergenerational living offers several benefits, different countries and contexts may see the makeup of households shifting

with demographic change, creating the risk that more older adults will be living alone in some areas.

Conclusion 4-4: Generating increased social inclusion in communities will require a multidisciplinary and layered approach combining strategies from various sectors. Targeted efforts are needed to strengthen social networks and reduce loneliness, especially in places where demographic shifts are leading to smaller families and family separation.

Metrics

Similar to this report's findings and calls to action, the WHO *Decade of Health Ageing* (2020) report advocates for ensuring that communities tap the abilities of older people and foster intergenerational cohesion, calling for the inclusion of older adult voices and stimulation of intergenerational dialogue. Related to fostering social inclusion, the WHO report suggests the following metric to gauge progress:

- Indicator 5.4.1: Proportion of time spent in unpaid domestic and care work, by sex, age and location, as a basis for provision of public services, infrastructure, and social protection policies.

In addition to the SDG indicators, some countries now capture and publish measures of well-being, which are aligned with the SDOH in the WHO list. For example, the United Kingdom has created a dashboard to track "Measures of National Well-Being" to support its national program, and monitors the personal well-being, relationships, health, work, leisure activities, and living situations of citizens, among other indicators (UK Office for National Statistics, 2019).

Additionally, the Active Ageing Index is a tool that can measure the untapped potential of older people for active and healthy aging (UNECE/European Commission, 2018), providing a mechanism to guide public policies. Relevant to the key target of social inclusion, the index measures

- the number of older adults who provide care for children, grandchildren, or older adults;
- the number of older adults who live independently;
- relative median income and those with no poverty risk;
- mental well-being; and
- level of social connectedness (measuring contacts outside the household occurring by choice).

However, the Active Ageing Index has been tested only in Europe, and other countries may require a broader set of metrics for evaluating their environments

for aging. The Scaling Healthy ageing, Inclusive environments, and Financial security Today (SHIFT) Index (*The Economist*, 2019b) benchmarks each G20 country's performance using 59 subindicators. Categories related to this chapter include the following, with additional detail on methodology found in the above-referenced article in *The Economist*:

- Indicator 1.3: availability of health and social care services;
- Indicator 3.1: social cohesion and participation; and
- Indicator 3.4: presence of inclusive social institutions.

Research Questions

More research is needed to identify the best intergenerational policies and programs and inform the creation of new policies and programs. The development of intergenerational programs has been increasing around the world to build social cohesion and bring benefits to multiple age groups, but how best to design such programs for successful implementation and optimized effects remains unclear. More monitoring and evaluation of these programs, especially to understand the return on investment, can provide important insights for communities looking to enhance their social inclusion and reduce loneliness among their residents.

As the proportion of older adults continues to grow, another question that could illuminate life-course trajectories in many low- and middle-income countries is the underappreciated role of young caregivers, especially for older family members. A systematic review has highlighted the positive and negative impacts on young people's everyday life, but more studies are needed to better understand different aspects of caregiving and design appropriately tailored services (D'Amen et al., 2021). There also are unknown societal costs of having young people forego their education to care for dependent older adults, costs that in Mexico, for example, have been estimated to be high (Gutiérrez-Robledo et al., 2021).

KEY TARGET: FINANCIAL SECURITY IN RETIREMENT

Comprehensive financial security systems are critical to mitigating socio-economic inequalities and providing opportunities for individuals and families to navigate their health, education, and work circumstances to contribute to society. Financial security is an ageless need. Regardless of work history, gender, disability, or position in society, all people require a reliable, adequate income over the life course. Financial security benefits everyone because people with a secure income can contribute to their communities, have good quality of life, and live with dignity. But the right systems, structures, and opportunities must be in place for population-wide financial security to become a reality. The collection

of these systems, structures, and opportunities can look different across regions and countries, but includes at a minimum pensions and social protection against poverty, vulnerability, and social exclusion; work that provides a fair income, safe working conditions, and equal opportunities; and access to financial services without discrimination (HelpAge International, 2021).

In many parts of the world, national and local governments are responsible for delivering on positive outcomes for the social enablers of healthy aging since they have the infrastructure and capacity to make change within and across generations. While high-income countries have established financial security systems, many low- and middle-income countries do not yet have such old-age protection for all of their population. Most countries offer old-age pensions to formal-sector employees only, leaving those in the informal work sector exposed to financial insecurity. Even in high-income countries, however, social security systems were instituted before population aging became an issue. Consequently, existing financial security systems were often designed for shorter lives and so lack mechanisms for adjusting the retirement age to reflect demographic change. Adjusting the retirement age is politically contentious in most high-income countries, but failure to do so can result in financial crisis, delayed disbursement, and reduced social pensions, affecting the most vulnerable older people who depend on social security for a living. Globally, this challenge can be an opportunity for those nations with less well-developed systems to design a better system from the ground up and learn from past lessons of other countries that will need to redesign their financial security infrastructure to be a more appropriate fit for the future.

Financial security schemes are an example of equitable income access and transformation of opportunity structures within communities, supporting the most vulnerable people in society. As described previously, poverty can have a critical influence on life expectancy, and differences of just a few miles within a city can translate into several years added to or subtracted from a person's life. A few countries (e.g., Australia, Denmark, the Netherlands, Switzerland) have successfully implemented systems that include generous health-promoting social structures, usually, although not always, means-tested, to meet the objective of alleviating poverty. They also have mandatory private saving plans, sometimes called "prefunded" plans, to help achieve consumption smoothing—essentially, the tendency of individuals to alter their spending and saving habits throughout their life depending on available resources. These designs are much more sustainable than others, as indicated by a global pension index that routinely places the systems of these countries near the top of its rankings for their sustainability (Mercer, 2021). Still, striking differences are evident across regions and countries with regard to pension availability and the structural and sociocultural contexts in which they were created. For example, only 12 African countries have established national pension schemes, and only 5 of those are universal (He et al., 2020). Furthermore, it is estimated that worldwide, more than 95 percent of

people above retirement age in Europe receive a pension, while this is the case for only 26 percent in Central and Southern Asia and 23 percent in sub-Saharan Africa (UN, 2018).

> Finding 4-8: Regardless of their work history or social status, financial security into older age can allow people to live with dignity, contribute to their communities, and have good quality of life, especially when they are unable to work. Absent this security, lack of access to necessary resources can have a detrimental effect on people's health and life span.

Testing Different Social Protection Models

Projections of increasing life expectancy across countries and the continued disparities among racial and socioeconomic groups help make the case for a widespread commitment to financial security for older people, although different cultures and communities may need to customize their financial security schemes to fit their populations' unique needs. A series of papers demonstrates that means-tested social pensions are advantageous in economic welfare terms compared with alternative formulations (Kudrna, 2017). The alternative formulations examined employ contributions-based and earnings-related social security, as in the United States, or a universal, flat-rate, noncontributory social pension.

Several mechanisms explain the benefits of a means-tested social pension. First, the lower revenue requirement with means testing reduces the tax increases needed to finance the pension scheme. Additionally, higher-income households have the most discretion over their saving and labor supply, so means testing avoids the potential adverse incentive impacts of a universal pension. Finally, a social pension with a single access age operates regressively in the absence of a means test but progressively with a means test. Costs of administering a means test have been found to be much lower than those of tracking contributions for social security entitlements (Baker and Rho, 2011). The report of the Commission on Funding of Care and Support in the United Kingdom recommended continued means-tested support for those of lower means, noting that not everyone will be able to afford to make personal contributions (Commission on Funding of Care and Support, 2011). However, the commission recommended that those who enter adulthood and already have a need for care and support should be immediately eligible for state support without further inquiry.

Conversely, implementing these policies in countries with entrenched social security systems based on contributions from the formal workforce is politically very challenging. In emerging economies where most of the labor force operates informally, creating a new social protection system for all is more feasible. A lifetime of SDOH factors influences people's circumstances at older ages; those who have faced adverse consequences from SDOH across the life span are more

likely to have functional challenges that impact their ability to work and provide for themselves at older ages. A basic social pension allows people to exit the workforce—formal or informal—and still have the financial support needed to survive. Even if countries can start with a baseline minimal amount, these initial efforts can validate the concept and lead to incremental changes. The key is to structure and create policies and institutions that promote people's intrinsic societal value irrespective of age, ability, or choice to engage in paid or unpaid work. This basic precept aligns with the International Labour Organization's (ILO's) recommendation for national standards of social protection and "guidelines for implementing and monitoring national strategies that are participatory, country-led, sustainable, and regularly reviewed" (UN, 2013, p. 6). ILO also provides guidance to member states on progressively providing additional protection to as many individuals as quickly as possible, in accordance with a country's economic and fiscal capacities (Cichon, 2013).

Interventions to Ensure Financial Security

Many countries have tried various interventions to improve the financial security of their residents. These interventions range in breadth and depth depending on the country's needs and circumstances. In 2015, for example, Australia reformed its welfare system, which led to an investment approach that ensures that funds are invested in groups of people with the largest anticipated future lifetime costs and the capacity to transition to self-reliance. The approach was established as part of the country's 2015–2016 national budget, with funding totaling AUD66 million (Australian Government, 2015). A different approach was taken by Brazil at the turn of the 21st century, when it was facing high levels of hunger, poverty, and inequality in many of its densely populated cities. The government introduced the Programa Bolsa Família in 2003 to provide conditional cash transfers for low-income families to ensure that their children could attend school and receive childhood vaccinations. Years later, the program's results demonstrate that it has reduced the proportion of the country's population living below the international poverty line from 13 percent to 3 percent. Bolsa Família is also credited with 12–21 percent of the country's reduction in income inequality and is widely seen as a model for conditional cash transfer programs (Centre for Public Impact, 2019). While this program is focused on families and young children, the long-term effects of providing these levels of security for younger adults will be influential in their aging trajectory, improving their chances of healthy longevity.

Addressing the wealth of workers in the informal sector can present an added challenge for many low- and middle-income countries. The size of the informal economy as a share of GDP in Africa is the largest in the world (Guven et al., 2021). Understanding this group will be key to successfully expanding social

protection schemes, which will likely include instruments such as safety nets, economic inclusion programs, and productivity-enhancing measures—as outlined in the World Bank's report *Social Protection for the Informal Economy* (Guven et al., 2021). In Togo, for example, more than 92 percent of the workforce is considered informal (WIEGO, 2022). After years of stalled progress in including these workers in social protection programs, a combination of a top-down and bottom-up approach bringing together international organizations such as ILO and civil society advocacy groups led to better understanding on the part of the government and greater awareness among informal workers. As additional case examples, Box 4-5 highlights the design and outcomes of three recent social protection programs in low- and middle-income countries that have seen success.

BOX 4-5
Case Examples of Social Protection Programs
in Kenya, Bolivia, and Mexico

Understanding the importance of social protection programs, especially for older women faced with historical disadvantages, some lower- and middle-income countries are beginning to implement such programs. In 2018, **Kenya** rolled out a universal cash transfer program for all 833,000 Kenyan citizens aged 70 and older, fully funded by the government, an amount that translated to USD20 per month disbursed through local banks. Evaluations of the program are ongoing, but initial evidence shows that older adults receiving the pension "are living more independent and happier lives."

In 2008, recognizing that its contributory pension covered just 14 percent of older people, **Bolivia** implemented a universal noncontributory pension scheme for older people called Renta Dignidad. By 2012, the program was reaching more than 91 percent of the population over 60 and was costing approximately 1 percent of Bolivia's gross domestic product. The program is financed by income resources derived from oil production and then transferred to a fund to generate additional investment income. After several years, the government studied the impacts of the program and found that those receiving the funds had experienced reduced official and subjective poverty rates in their households. Additionally, children living in these recipient households were less likely to be working, and their enrollment in school was nearly universal.

In 2013, **Mexico** changed its eligibility threshold of the Social Pension Program for the Elderly from age 70 to age 65. Researchers evaluating the program found that the program's expansion "not only reduced the probability of older adults being extremely poor, but also narrowed the extreme poverty gap and reduced the extreme poverty severity indexes of the older population." They found neither short-term impacts on the labor force participation among older people nor that it reduced labor income. Finally, in contrast with other impact evaluations of similar programs, "the analysis did not find that the expansion of Mexico's program had a crowding out effect on domestic or international private transfers to older adults."

SOURCES: Avila-Parra and Escamilla-Guerrero, 2017; Mbaka, 2019; Mendizabal, 2014.

Levers for Empowering Change

Effective national social protection systems help build inclusive societies and reinforce "social cohesion by protecting individuals from social risk" and economic deprivation (UN, 2013, p. 4). Financial security systems are "a powerful instrument for providing income security and reducing poverty and inequality," and also play a role in ensuring older people's access to basic needs, such as health care, housing, education, and food (UN, 2013, p. 4). Yet, actionable policies to prevent the detrimental effects of poverty and inequality on health have still not benefited the most disadvantaged. If people have no income security or resources once they can no longer work, their chances of achieving healthy longevity decline significantly. Ideally, financial security systems would guarantee that all vulnerable people (not just older people) have a secure income from social insurance or a tax-funded minimum social pension to prevent them from falling into poverty, alleviate their financial dependence on family members (and thus reduce the risk of wider poverty), and ensure their financial autonomy and dignity. However, this vision will not come without challenges, as along with the increasing inequality within countries over the past decades, governments have faced decreasing resources. The World Inequality Report of 2020 notes that countries have become richer over the past 40 years, but the share of wealth held by public actors is close to zero, with the overwhelming share in private hands (Chancel et al., 2022). The low level of government wealth will make it difficult to implement social pension programs for a greater share of aging citizens.

The commission observes that countries will require different types of programs to improve financial security for older adults as appropriate for their populations and cultures. While recommendations similar to those in this report have been made before, they have not always been implemented. Different countries may internalize different perceptions of need, making decisions to prioritize other sectors with their limited resources. These are difficult decisions, sometimes based on incomplete or outdated information given changing populations, economic variability, and the increasing inequality within countries. Some countries, such as those featured in Box 4-5, have decided that the risks associated with protecting more of their population come with important benefits for their population's longevity, even if those benefits are realized only over the long term and only through iterative program designs. Regardless of the approach a country takes, greater knowledge and awareness among the public of the importance of financial security in older ages will be required. The Commission on Funding of Care and Support in the United Kingdom, for example, has recommended an awareness campaign on the importance of planning ahead, as well as robust information and advice strategies for the public so people can access reliable information on available services and funding sources (Commission on Funding of Care and Support, 2011).

Finding 4-9: The identification of eligible residents and payment of benefits to people in isolated communities have become feasible and reliable.

Finding 4-10: Financial security is an enabler of healthy longevity. Social pensions offer an effective way of delivering financial security for older populations and will become more prevalent as the demographic transition continues.

Conclusion 4-5: Financial safety nets for older people are essential to achieving healthy longevity, especially in low- and middle-income countries, where informal labor force participation is high. Regardless of work type, all people need to be covered by pension and social protection programs. Additionally, support for individual retirement savings will require that people have financial literacy and universal access to secure banking systems and investment opportunities.

Recommendation 4-2: By 2027, all governments should develop plans for ensuring basic financial security for older people.
a. **For countries without retirement income systems, introduce support for older people with no or subsistence-level income.**
b. **For countries with emerging retirement income systems, increase security for low-income older people.**
c. **For countries with robust retirement income systems, identify evidence-based models for strengthening financial security across the life course.**

Recommendation 4-3: To improve financial security in retirement, governments and employers should develop strategies for increasing financial literacy and mechanisms for promoting pension contributions, self-funded pensions, and lifelong savings.

Metrics

Other reports have advocated for greater financial security and income protection for citizens. The WHO *Decade of Healthy Ageing* (2020) report, for example, calls for support for income security across the life course. Additionally, the SHIFT Index (*The Economist*, 2019b) uses the existence of national pension systems as a metric for its scoring. And some SDG progress indicators align with the goals and targets discussed in this chapter, including the following (UN, 2021):

- Target 1.3: Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and vulnerable.

- Indicator 1.3.1: Proportion of population covered by social protection floors/ systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims, and the poor and the vulnerable.

Research Questions

Further research can guide new policies and programs to provide social protection for aging populations. Greater insight is needed in many areas. One area is the impacts of such policies on labor force participation and health status of older people, and the interaction between the two. As older adults seek to leave the workforce and maintain their wealth, research also is needed on alternative approaches for generating engagement in financial competence and knowledge. Financial literacy is one important focus; others include incentives to save for the long term, the long-term impacts of default design for saving, mandatory saving, and the links between life-course health patterns and financial security, all of which need more research.

KEY TARGET: DIGITAL LITERACY

Another contributor to the challenges of aging is the lack of digital literacy among older adults, whereby those who are unfamiliar with computers and new devices are increasingly being left behind as technology advances and becomes ubiquitous in daily life. This has led to the "digital divide." Physical access to broadband technology, discussed in Chapter 5, is one key component of addressing the digital divide. This section focuses on the social aspects and root causes of the lack of digital literacy and how it can be used to achieve healthy longevity.

Older adults continue to be the least likely age cohort to have access to the internet because of both physical and psychological factors (Chu et al., 2021). According to a European Union report, one-third of older adults reported never using the internet (Anderson and Perrin, 2017). This issue has been percolating below the surface for years, but the onset of the COVID-19 pandemic has amplified its importance. In China, for example, news reports highlighted an older woman who wanted to pay for her medical insurance in cash but was refused because of contamination concerns. Because she did not have mobile payment capability, she was left without options. Similarly, an older man in China was refused bus access because he did not have the mobile app to show his health status code (Kidron and Yang, 2021).

Reasons for this lack of digital literacy are numerous. One study in South Korea examining people over age 55 found digital engagement to be significantly influenced by factors such as gender, academic background, usage motive, life satisfaction, and household type (Yim et al., 2020). Interestingly, in Singapore, poor health has been found to be a main cause of the digital divide among older

people, as health problems can affect a person's online communication and social activities within their networks (Ang et al., 2021). In Latin America, many older people live in homes with internet access, but they do not use the internet, highlighting barriers such as lack of motivation or desire (Sunkel and Ullmann, 2019). Given that there is no single reason for the lower levels of computer and internet use among older adults, solutions for increasing digital engagement across this population will be multifaceted.

Recently, a Lancet and Financial Times Commission stated that weak governance of digital technologies contributes to inequities and compromises human rights (The Lancet and Financial Times Commission, 2021). While much of that commission's focus is on youth, especially in low- and middle-income countries, interventions beginning with young people and continuing across the life course can have important implications as people age. Those who are educated in and immersed in digital technologies from a young age will likely continue to use technology throughout their lives. The Lancet and Financial Times Commission argues that digital access is a determinant of health, and technology needs to become a positive driver for equity. Otherwise, existing inequities will be exacerbated by the widening digital divide.

A WHO report addresses "the potential interplay between ageism and AI [artificial intelligence] for health as it affects older people, including the conditions in which AI for health can exacerbate forms of ageism and whether use of AI for health introduces new forms (or risks) of ageism" (WHO, 2022a, p. 3). The report emphasizes that "[l]egal, nonlegal, and technical measures can be used to minimize the risk of ageism in AI and to maximize its use for older people as these technologies become more widespread" (WHO, 2022a, p. 2). As AI technologies revolutionize aspects of public health and medicine and can be especially important for older people who have several comorbidities or conditions to monitor, the technologies can lead to harm without careful and ethical oversight. Indeed, numerous studies have highlighted the potential for embedding biases in AI systems as they rapidly develop (Chu et al., 2021). A WHO policy brief on Ageism in Artificial Intelligence for Health notes that the datasets used to train AI models and improve machine learning often exclude older people. Additionally, it is rare for design teams building these models to include older people; instead, they overwhelmingly include young White men. This increases the likelihood that older people will be excluded from new AI technology and that technologies targeting them will be inappropriate. Remedies for this challenge include leveraging participatory design approaches for AI technologies to involve older people, and having age-inclusive data collection and age-diverse data science teams (WHO, 2022a).

Interventions to Improve Digital Literacy

As with many interventions, implementation focused on digital literacy will have multiple positive effects across policy needs for different groups. Lifelong

learning opportunities and affordable, accessible "smart" digital cities and rural and remote communities can help ensure that the needs and abilities of older people and those with disabilities are addressed. As these interventions proliferate, however, the importance of equity in opportunities will remain central.

Improving digital inclusion among older adults will require increased access to and motivation to use the internet and computers and digital skills. To address these various factors, countries in Latin America have implemented programs to promote digital inclusion among older people. For example, a pilot program was launched in Uruguay in 2015 to advance equal access to knowledge and social inclusion among retirees (Sunkel and Ullmann, 2019). Targeting low-income older adults, 100,000 electronic tablets designed for older adults were provided during a workshop in which participants were taught how to use the technology and relevant apps. Keeping in mind multigenerational and life-course concerns, the program also included a campaign to help children and grandchildren of the beneficiaries use the technology.

Levers for Empowering Change

To improve digital inclusion, a Brookings report by Tomer and colleagues (2020) emphasized the need to engage trusted actors and institutions from the private and public sectors when evaluating needs and developing interventions for specific populations, such as communities of color and immigrants. Primary schools, public libraries, and other nonprofit organizations are potential providers of digital literacy interventions. Additional targeted efforts to understand what digital skills are necessary for work and how to build those skills are also needed.

Increasing older people's access to and familiarity and comfort with digital technologies have the potential to decrease isolation, increase engagement, and improve access to virtual services such as telemedicine, as seen during the COVID-19 pandemic (Haase et al., 2021). Access is inhibited, however, by ageist myths that older people are rigid in their thinking or unable to understand and use emerging digital tools. Investing in digital infrastructure designed for older people and incorporating age-diverse representation in AI and machine learning algorithms could help to close the digital divide.

> Finding 4-11: Education to increase digital literacy among older people can help them to integrate into societies with rapidly changing technological advances and provide them with increased opportunities for engagement.

> *Conclusion 4-6: As technology rapidly advances, targeted digital literacy efforts, paired with participatory design for AI technologies to involve older adults and age-diverse data science teams, are needed to enable older adults' full participation in society.*

Metrics

Also relevant to the need to narrow the digital divide and improve digital literacy among older adults, the WHO *Decade of Healthy Ageing* (2020) report highlights indicators related to the SDGs but modified to track the progress of older adults specifically:

- Indicator 4.4.1: Proportion of young people and adults skilled in information and communications technology, by type of skill, also distinguished by older people; and
- Indicator 17.8.1: Proportion of individuals using the internet (disaggregated by age).

Research Questions

While there is a wealth of research on the benefits of volunteering for both physical and mental health (see Chapter 3), the potential for older adult volunteers to act as ambassadors to other older adults to promote digital literacy represents a research opportunity. Calls from the United Nations to collaborate across the public and private sectors to create more user-friendly technologies and engage older people in digital societies note the need for shared understanding of older people's values and abilities to cocreate digital environments (UN, 2019b). Research exploring how best to meet this need using older adult volunteers more accustomed to technology but straddling both the digital and nondigital worlds could provide important new insights and methods for achieving these goals for healthy longevity.

As discussed previously in this chapter, the growing field of human-centered design and greater attention to participatory research and engagement of target audiences and end users should be a key facet of future research efforts. The Roadmap for AI Maturity in Health outlines key maturity indicators for assessing the design process for AI in health (Broadband Commission, 2020). Given that roadmap's goal of putting humans at the center, there is an opportunity to augment the current list by creating an indicator that measures the representation and participation of older adults as part of the testing of datasets used to create and validate digital innovations. Using participatory design approaches to develop and understand this indicator can help improve the inclusivity and sustainability of digital designs.

CONCLUSION

Many aspects of healthy longevity are influenced by social determinants that cannot be addressed or resolved within the health system. Interventions geared toward building social cohesion and social capital within communities can con-

tribute to the cultural change needed for older adults to be more engaged in their societies. But to achieve the goals set forth in Chapter 2 and at the beginning of this chapter, these interventions also need to be paired with policies that work to combat ageism, promote social inclusion, protect the financial security of older adults, and improve opportunities for developing competence in using technology. Additionally, all of these areas would benefit from greater understanding and insight, so it will be important to ensure that translational research is funded and conducted across an array of areas to inform governments and other stakeholders when designing policies and fostering cultures of inclusion. For the findings emerging from research to be most useful and generalizable, translating and testing them in real-world settings will be a valuable addition to knowledge generation.

Older people already have meaningful roles in society as they age, but the need for new opportunities will grow with the rapid aging of populations. Meaningful engagement can yield a multiplicity of benefits for both aging populations and society. In terms of healthy longevity, challenging expectations, particularly in terms of opportunity structures, is one of the most important elements of achieving Vision 2050. Integral to the discussion in this chapter is the cross-cutting theme that the intersection of family, community and social cohesion, and equity has a vital role in achieving healthier, longer lives. Addressing these diverse but interconnected determinants holds promise for helping to achieve healthy longevity for the greatest number of people around the world. The ability of social and behavioral enablers to feed into the opportunities for healthy longevity is limitless, providing building blocks for measuring success and progress toward the world the commission envisions for 2050.

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5

Physical Environment Enablers

While the physical environment has many aspects, this chapter focuses on those aspects the commission believes are most consequential for realizing its vision and goals related to the physical environment. The key targets for physical environments, along with the recommendation and supporting structures to achieve the physical environment goal, are provided in Figure 5-1.

Characteristics of the physical environment influence the health and well-being of all people across the life course. A considerable body of evidence links the physical environment to health and well-being (Bird et al., 2018). The World Health Organization (WHO) suggests that 24 percent of death and disease can be linked to environmental hazards, including poor water quality, poor water availability, sanitation, infectious diseases, air quality, harmful substances, and climate change (WHO, 2022a). As discussed in the previous chapter, the social determinants of health and the environmental conditions in which people live, work, play, and age have extraordinary impacts on well-being and health. Specifically, how an environment is designed and built can have positive or negative influences on health, social engagement, and access (or lack thereof) to essential services. In response to the WHO Age Friendly Cities Initiative, many places around the world have begun designing "age-friendly cities" and creating opportunities for older adults to age in a healthy and more holistic way (WHO, 2022b).

This chapter focuses on how healthy longevity intersects with key aspects of the physical environment, such as housing, public space and infrastructure, transportation, climate change and environmental hazards, and digital access. The discussion in each section touches on the cross-cutting issues of achieving equity and of best practices and promising interventions for promoting a healthy physical environment. The built environment influences human health in complex

129

Physical Environment Enablers Key Targets

Housing, public spaces and infrastructure, transportation, digital technologies, and climate change & environmental hazards

2022 - 2027

Recommendations for Next 5 Years

(full text at end of Chapter 5)

5-1. Design user-centered and cohesion-enabling intergenerational communities for healthy longevity

2022 - 2050

Examples of Supporting Structures

- Inclusion of older people in codesign and user-centered design of the built environment
- Public spaces that promote social cohesion and intergenerational connection, while also encouraging physical activity
- Age-friendly community and housing design protocols that enhance access to food, transportation, social services, and engagement
- Programs to mitigate the effects of environmental emergencies on older people
- Reduction of air pollution

2050

Goals

6. Physical environments and infrastructure that support functioning and engagement for people at older ages

FIGURE 5-1 Physical environment enablers roadmap.

ways and requires a "community-based, multilevel, and interdisciplinary research approach" (Srinivasan et al., 2003, p. 1446). The influence of place reflects a complex interplay among the key targets discussed throughout this report (see Figure 5-2).

The physical environment's effects on health and well-being are evident across the life course, with negative effects accelerating as people age. The pace of biological aging and risk of chronic disease can often be linked to environmental exposures in early childhood, or even before an individual is born, because these are key periods for human development (Wang et al., 2021). A study in the United States, for example, measured the effects of social and physical environments on birth outcomes and found that measures of traffic exposure (i.e., air pollution) in utero were associated with lower birthweights (Zeka et al., 2008). Low birthweight can have long-term effects, including poor motor skills, poor vision, and chronic health problems (Hack et al., 1995). Investments in the physical environment, including forward-thinking prevention and mitigation interventions addressing climate change, are needed to enhance well-being at all
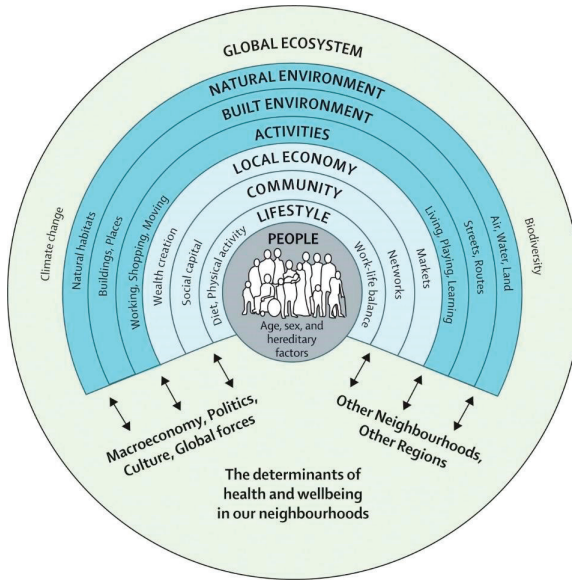
FIGURE 5-2 The determinants of health and well-being in the physical environment.
SOURCE: Reprinted from *The built environment and health,* Rao et al., 2007, with permission from Elsevier.

stages of life (Wang et al., 2021). While this report emphasizes interventions for and needs of older adults, neglecting the cumulative exposures acquired over the life course and the interventions that could be implemented earlier in life will result in missed opportunities for impact and less progress made toward healthy longevity for all. The commission believes that the key targets discussed in this chapter can positively influence people of all ages, setting them up for a more positive trajectory toward longer, healthier life spans.

KEY TARGET: HOUSING

Housing is a primary component of the physical environment that can influence a person's ability to achieve healthy longevity. The home, together with the built environment around the home, is critical to one's quality of life and the ability to remain independent. For many, maintaining independent living will be the goal. For those unable to live alone, however, thoughtfully designed elements in group housing can improve quality of life. Regardless of location, numerous inequalities exist in housing for older adults, which are amplified in disadvantaged environments and for those who lack basic water and sanitation. These inequalities play a critical role in influencing a person's healthy longevity

throughout the life course. Important considerations for housing include universal design; affordability; and health and safety, including basic services such as water, sanitation, and hygiene. Finally, the proximity of a living space to food and resources will also play an important role in influencing healthy longevity.

Universal Design

One means of achieving independent and autonomous living for adults as they age is universal design, defined as intentionally developing environments and products to be easily accessed and used by a wide range of people (Farage et al., 2012). Although employing universal design principles[1] at the initial stages of planning and designing housing results in 1 percent or less additional cost, the concept has yet to be widely adopted (Snider and Takeda, 2008), limiting many older people's ability to perform such activities of daily living as bathing and moving around the home. Policies can encourage the development of accessible housing stock by incentivizing or requiring universal design features for all new homes. Designing homes with features that increase accessibility and independence for those with mobility challenges creates housing stock that is suitable for all members of society, not just older adults.

Availability and Affordability

The availability of affordable housing of adequate size and design and with access to community and social institutions is also a key component of healthy longevity. While many people say they want to stay in their home as they age, which enables more autonomy and continuation of social connections, doing so may pose challenges. For example, if children move out or a spouse dies, houses built for families may be more space than a single older person needs and too much for the person to manage. Depending on housing markets, younger people may be unable to afford to purchase or rent dwellings of the size that their parents could afford, raising questions about intergenerational equity. To address this challenge, policies that make it attractive for older people to downsize as they age are needed. As discussed in Chapter 4, there are also emerging programs pairing older and younger generations to address both the lack of housing available to young people and the need for more assistance for older adults.

Additionally, many older people of lower socioeconomic status are more likely to live in poor-quality housing for much of their younger years, often in environments that are not conducive to social integration and mobility (WHO, 2015). The benefits to their longevity of having them remain in these locations

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[1] Universal design principles include having a "no-step entry, all living space on one floor, switches and outlets at easily reachable heights, wide hallways and doors, and lever door handles and faucets" (Guzman et al., 2017, p. 1).

will be limited. Understanding specific demands in different areas can help policy makers and community leaders be more proactive in their approaches to this issue. As found in a study in Mexico, for example, housing arrangements in middle age have been found to predict housing needs in older age. Overcoming typical limitations of not having long-term data, the researchers found that typical living arrangements for adults at age 50 predicted their future living arrangements, with the potential to inform public health and other urban design policies (Huffman et al., 2019). As the older population grows, the need for affordable housing will increase, and policy makers need to take this need into account.

Health and Safety

Health and safety risks posed by poor housing conditions in infancy, childhood, and adulthood are similar in magnitude to those posed by smoking and alcohol consumption and can contribute to downstream mental and physical health conditions later in life (Howden-Chapman, 2004). The WHO Regional Office for Europe compiled a list of factors associated with inadequate housing, such as mold, lack of smoke detectors or window guards, overcrowding, indoor cold, traffic noise, and lead or radon exposure (Braubach et al., 2011). It summarized the evidence for the significant health consequences of these factors, which include asthma mortality and morbidity, injury deaths, lung cancer, respiratory problems, and cardiovascular disease, all of which affect people across age groups. Likewise, a German longitudinal study followed households for 25 years and found that, among people aged 64 and older, those living in homes needing minor renovations or major renovations had, respectively, 6 percent and 20 percent more physician visits than those living in homes needing no renovations (Palacios et al., 2021).

Taking a closer look at safety within the home, "falls are the second leading cause of unintentional injury deaths worldwide" and pose a serious risk to older people, who suffer the greatest number of fatal falls relative to other age groups (WHO, 2021a). However, children are another high-risk group for falls, so improving housing design and standards to prevent falls can address a problem that spans age groups. A study of older adults in Nigeria found that "28.4% [of] respondents believed that houses that were dark, ill-ventilated, damp and dilapidated were dangerous to health of the aged living therein. Poor lighting coupled with steep slope of stairs and slippery floor finish had caused falls and collision with objects among 18.2 [percent of] respondents" (Alabi and Fatusin, 2018, p. 174). Potential modifications to prevent falls and address other health aspects of housing conditions are presented in Box 5-1.

BOX 5-1
Successful Models of Housing Modifications

Numerous studies have shown that such modifications as weatherizing, insulation, and "green" housing can improve the health of residents. For example, a U.S. study examining the effect of green renovation within low-income housing found that self-reported health in adults improved from 59 to 67 percent. This increase was aligned with measured improvements in water problems, allergen dust loading, and the presence of pests and use of pesticides. Adults specifically reported a lower prevalence of angina, hay fever, and sinusitis, along with better emotional states, including less sadness and hopelessness. Improving physical and mental health for adults, even at younger ages, can translate to better health status and functioning as they age.

Other basic improvements in housing for older adults can also lead to more autonomy and increased likelihood of aging in place. After hearing from residents in Tsuen Wan District, Hong Kong, that housing modifications were a priority, local leaders implemented a program for 300 households to improve accessibility through a joint partnership. Residents could choose from installation of a grab bar, replacement of fluorescent light bulbs, installation of a raised toilet seat, lighting installation, adjustment of a TV antenna, or wall repainting. "Both younger and older volunteers from the local community visited older adults and people living with disabilities to talk to them and listen to their perspectives. This allowed the social service agency to identify the older adults' specific needs and to plan follow-up action" (WHO, 2017a). These volunteers played a major role in building rapport and establishing trust with the older residents, enabling greater trust in the project itself and building community.

SOURCES: Jacobs et al., 2014; WHO, 2017a.

Water, Sanitation, and Hygiene

The availability and quality of water, sanitation, and hygiene are essential for all people to cook nutritious food, avoid waterborne pathogens, and maintain a socially acceptable level of hygiene. Less than half the population in 42 countries have basic handwashing facilities in the home (Seghers, 2020). In the Democratic Republic of Congo, Lesotho, Liberia, and Rwanda, only 5 percent of the population have access to these facilities, while this proportion is less than 30 percent in Haiti, Vanuatu, Bolivia, and Timor-Leste (Kashiwase, 2020). This lack of access to basic services can also have negative effects across generations, setting individuals up for challenges across the life course. A study in India, for example, found that pregnant women who spent more than two hours per day fetching water were 33 percent more likely to have a baby born with low birth-

weight (Baker et al., 2018). Those who shared a compound latrine versus those who did not were also more likely to give birth preterm.

While more pervasive in low-income countries, these problems are seen as well in middle-income countries, where they are also associated with poor health indicators. Water supply, sewerage, and access to indoor shower facilities and washrooms were key components of a composite measure of built environment that was applied in Brazil. Using this measure, researchers found positive associations among community dwellers 60 years and older between adverse conditions of the built environment and respiratory, urinary, and gastrointestinal conditions, as well as headaches and visual impairment (Blay et al., 2015). In South Africa, "community level provision of built resources of basic services (i.e., water, sanitation, electricity, housing) has a modest but significant impact on older persons' subjective well-being" (Ralston, 2018, p. 111). However, individuals with chronic illness did not receive the same benefit as those without such illness, pointing to the importance of providing these basic services to a community before its residents develop chronic conditions.

Housing in Informal Settlements

Housing challenges are amplified in informal settlements, sometimes referred to as "slum" environments. Informal settlements are characterized by lack of access to safe water, sanitation, and durable infrastructure; insecure tenure of individuals in their housing; and a high density of residents (UN Habitat, 2006). The informality of these settlements—when residents are not registered with the municipality—influences the lack of access to the amenities and services important for health (Weimann and Oni, 2019). Inhabitants are also more vulnerable to consequences of urban development projects as well as climate and natural disasters, all of which can displace them.

Residing in informal communities negatively impacts health and health-seeking behaviors. A study of informal settlements in Rio de Janeiro, Brazil, found healthy life expectancy was twice as high in more affluent areas than in the slum settings (Szwarcwald et al., 2011). Researchers who examined residents in two informal settlements in Kenya noted associations with multiple adversities among older people, including mobility issues, lack of access to basic health services for cardiovascular and musculoskeletal conditions, and mental and emotional stress heightened by overcrowded family homes (Aboderin et al., 2017). WHO's age-friendly communities and cities program, which emphasizes age-focused living standards that meet the needs of older adults, can guide efforts to upgrade or create alternatives to informal settlements. As written, however, the program's indicators do not capture mental and emotional well-being challenges arising from basic housing quality.

Access to Food and Resources

Chapter 4 highlights the critical interplay among social determinants of health, poverty, and life expectancy. A steepening longevity gradient across cities and regions poses troubling questions about how health, prosperity, and environment have uneven impacts across the social landscape. One key aspect of healthy longevity is a healthy diet of nutritious food. But lack of access to and availability of nutritious food can be a challenge for people across the life course depending on their circumstances, particularly income level and geographic location. For example, the effects of poverty can include food insecurity due to a lack of financial security and challenges in the affordability of nutritious food. In addition to affordability, the length of travel necessary to procure nutritious food can be a barrier.

In the Global North, the concept of "food deserts"—"areas with limited access to affordable and nutritious food"—is recognized for its impact on food security for many households (Jones, 2011). Food insecurity intersects with housing-related factors in important ways. For example, researchers in Ontario, Canada, found that, relative to the overall prevalence of food insecurity among seniors, twice as many older adults living in subsidized housing experienced food insecurity (Pirrie et al., 2020). Additionally, women can be more vulnerable than men to food insecurity; researchers in Portugal found that 26.5 percent of older females reported being food insecure, compared with just 18.9 percent of older males (Fernandes et al., 2018). In higher-income countries, the placement of new housing developments, especially for older adults, near community centers or the introduction of farmers' markets in underserved areas can partially fill the gap in food access. But without close proximity to these resources, people will rely on transportation. Thus, communities suffering from decades of structural racism or economic disinvestment that leads to a lack of robust transportation options will also be more food insecure (Beatrice et al., 2021; ODPHP, 2022).

The concept of food deserts, even in urban areas, is less relevant to measuring levels of food insecurity in countries of the Global South (Wagner et al., 2019). Because of the fluidity of the informal food economy in these areas, proximity to sources of food can be difficult to assess. Research on the application of this concept in the Global South is limited, but when analyzing access in Nairobi and Mexico City, researchers concluded that "food deserts in the Global South should not be understood through the proxy measurement of supermarket access" (Wagner et al., 2019, p. 13). Households in both cities accessed multiple types of food-sourcing options (Wagner et al., 2019). Additional research is needed to explore the structural drivers of inequities in food sourcing within urban environments in the Global South. However, given the dependence on agriculture for many in these countries, additional threats to food security, such

as climate change, protracted conflicts, and economic stalls (as seen during the COVID-19 pandemic), will continue to be at the forefront and demand attention (Whiting, 2022).

The demographic challenge of population aging also intersects with food insecurity in other ways, as the average age of farmers worldwide is 60 years old (Vos, 2014). In low- and middle-income countries, adults over the age of 55 make up approximately 30 percent of agricultural holders, and agriculture is often their main source of income (Heide-Ottosen, 2014). But, due to age discrimination and the perception of older farmers as unable to learn new skills, they are often excluded from productive resources and training on innovative technologies.

Inequality in access to nutritious food is also seen in low-resourced environments, such as informal settlements or refugee camps in low- and middle-income countries. A HelpAge International study conducted in Kenya found that more than 50 percent of people aged 60 and older living in refugee camps were in need of nutritional support as the result of a lack of access to food rations and a low-diversity diet (Fritsch and Myatt, 2011).

Levers for Empowering Change

Living environments could be redesigned in the near and longer terms to accommodate all ages in society, with attention to affordability, health, and safety. Especially as many countries continue to see a rise in their older populations, it is important to think about how best to accommodate older people with various housing options to promote optimal functionality and healthy longevity. Studies included in a review of evidence assessing housing interventions consistently found that providing housing and supports reduces emergency department visits and hospital stays and can generate a return on investment of USD1.57 in savings for every USD1 spent (Tsega et al., 2017). Multiple approaches can be applied to this end, such as increasing the availability of housing appropriate for independent living and making modifications to increase access to transit and needed services.

Additionally, proximity to resources such as nutritious food can have clear impacts on healthy longevity. Tsega and colleagues (2017) found evidence that access to healthy food among vulnerable populations is associated with lower health care costs and utilization. The ability to access health and social services is an important consideration when developing new housing projects and solutions to promote healthy longevity. Finally, "it is crucial that [older farmers] have equal access to productive resources and training on innovative technologies" (Heide-Ottosen, 2014, p. 21), to benefit farmers and to maintain an adequate global food supply.

Finding 5-1: Housing that encourages independence, social integration, and mobility is a key factor in older adults' ability to realize healthy longevity, but the availability and affordability of this type of housing are limited, especially for those with limited financial resources.

Conclusion 5-1: To achieve global healthy longevity, safe and accessible housing that allows older people to age in place is critical. To ensure that housing and community design meets their needs, older people need to be included in user-centered design processes when modifying existing or creating new housing. Housing that supports aging in place can be encouraged through universal design standards, embedded health and social services, and "smart" technology adaptations that encourage independence. For some countries, especially those with informal settlement environments, providing housing that has sufficient water, sanitation, and hygiene is a critical first step toward achieving healthy longevity.

Finding 5-2: The proximity of a person's living space to critical resources such as food can facilitate healthy longevity. Without food security, people are at risk of several comorbidities, such as dementia, depression, and functional dependence. Studies have found a high prevalence of food insecurity in older populations across several countries, affecting women more than men.

Conclusion 5-2: Given older people's vulnerability to malnutrition and the comorbidities associated with poor nutritional status, housing options for older adults need to take into account the accessibility of such essential needs as nutritious food.

Metrics

To measure progress on the goals and recommendations of the roadmap set forth in this report, many existing metrics can be used from related reports and initiatives around the world. Several examples are provided here for consideration when cities or countries are attempting to track their progress toward healthy longevity. United Nations (UN) Sustainable Development Goals (SDGs) 9, 11, and 13 are particularly relevant to efforts linking health and the environment, and using those indicators can provide an established mechanism for measuring progress. The following SDG indicator is especially aligned with this key target of housing (UN, 2022):

- Indicator 11.1.1: Proportion of urban population living in slums, informal settlements or inadequate housing.

While the concept of "food deserts" has limitations with respect to being applied universally, the Global Food Security Index uses 59 indicators to measure food security across 113 countries. Indicators include "affordability, availability, quality, safety, and natural resources and resilience" (The Economist Group, 2022). The index can be downloaded and customized for different areas.

Research Questions

While an abundance of evidence has been generated over the past few decades on the importance of the physical environment and its relationships to health and longevity, questions remain about how a community's context or the implementation of interventions, such as housing for older adults, may influence the strengths or characteristics of relationships. A study in England found an implementation gap between existing policies and actual housing options for older people in a region with a high proportion of older adults (Robinson et al., 2020). The authors argue that future research should seek to understand whether municipal or sheltered housing can facilitate aging in place for older adults and whether it can reduce the need for people to move into residential care, as well as what the cost savings might be.

KEY TARGET: PUBLIC SPACES AND INFRASTRUCTURE

Like housing, public space and community infrastructure are important to health and well-being from birth until death. Public spaces impact mobility, which in turn influences people's ability to interact with other people within families, communities, and regions (Webber et al., 2010). Public spaces also represent an opportunity, as the World Bank estimates that one-third of a city's land area is covered by such spaces (World Bank, 2020). Multiple neighborhood resources, such as parks, places to sit, and public transportation, are positively associated with older adults' active travel (Portegijs et al., 2020). As discussed in Chapter 4, increased opportunities for social engagement and interaction across generations can positively influence healthy longevity. Intentional design of public spaces can strengthen social cohesion, promote urban health and citizen well-being, and support the local economy (World Bank, 2020). Government leaders and the general public are pressing for intentional design of public spaces that promote healthy longevity. While there are numerous angles to consider when creating and designing public spaces, the commission prioritizes the characteristics most directly affecting health and healthy longevity, including green space, walkability,

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BOX 5-2
Case Study: Transforming Plaza 31 in Lima, Peru

With a confluence of scarce public spaces, fragmented governance, high costs of maintaining green spaces in a desert atmosphere, and historical segregation and violence, the equitable availability of usable public green spaces in Lima, Peru, was very limited. As part of its efforts to change this situation, the local government of the San Isidro district transformed parking lots into a place to gather. The space serves a wealthier neighborhood and a lower-income neighboring district.

Over 3 months, authorities transformed 2,000 square meters of parking lots and roads into a pedestrian plaza. "Today, the renovated plaza has green spaces, more than 30 newly planted trees, free wireless internet access, and benches and resting places accessible to people with disabilities" (Kaw et al., 2020, p. 275). This transformation also addressed citizens' security concerns. In addition, land use changes made as part of the project helped bring new commercial uses to the neighborhoods, such as the municipality's second gym.

While some residents were fearful of visitors from neighboring districts, local leaders emphasized the need for equity in public spaces and stated that those spaces should be for anyone and could not be restricted to certain individuals. These leaders engaged diverse groups of people, often younger than the average age of residents, to bring different insights to the project—an example of user-centered design.

"The transformation of Plaza 31 has led to a fourfold to fivefold increase in the number of people who use the plaza for resting, eating lunch, meeting friends, reading, strolling, and so forth" (Kaw et al., 2020, p. 277). All respondents in a survey of users rated the project positively, and 36 percent noted that they used the space multiple times per week. Finally, as a nod to increasing social cohesion and belonging, 93 percent said the transformation made them feel a part of San Isidro.

SOURCE: Kaw et al., 2020.

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and safety. Box 5-2 presents a case study in Lima, Peru, highlighting these three characteristics, in which local government transformed underused parking lots to a vibrant public space.

Green Space

Green space, including public parks, playgrounds, and residential greenery in urban environments, has positive health benefits across all ages, ranging from improved physical and mental health to reduced mortality (Braubach et al., 2017). A recent systematic review across seven countries concluded that green urban spaces can help people live longer and avoid premature death. The researchers concluded that "interventions to increase and manage green spaces should be

considered a strategic public health intervention" given that all-cause mortality increases as the greenness decreases (Rojas-Rueda et al., 2019, p. e469).

Specific benefits of green space have been demonstrated among different population segments as well, including protective effects on sleep deficiency for people over age 65 and increased physical activity for adults over 60 (WHO, 2016). Another study of older adults in Bogotá, Colombia, found that higher density of public parks was associated with better self-rated health (Parra et al., 2010). Recognizing these benefits, several regional and global agreements and declarations include language about improving access to green space. In particular, SDG Target 11.7 calls for "universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities" (UN, 2022). However, the current distribution of these green spaces within cities is often not equitable, so improving access to these benefits for all populations is an important policy goal for city and country leaders as they consider ways to optimize healthy longevity.

In addition to parks and public squares, community gardens are another form of urban green space that have gained attention recently. The emergence of "urban agrihoods" in the United States represents an attempt to provide an alternative neighborhood growth model, positioning agriculture at the center of mixed-use development. This approach not only increases green space within urban environments but also can encourage mobility and walking while increasing access to locally grown foods. One example is a recent collaboration in Philadelphia, Pennsylvania, that established a community garden program to give older immigrants the opportunity to volunteer, meet community members, and grow food for their families (US Aging, 2022). Community gardens that are accessible to older adults create opportunities for nonstrenuous exercise and social interaction with varying age groups. Community gardens have also demonstrated numerous benefits in the Gambia, including job creation; empowerment of women and youth; and greater levels of food security, nutrition, and health for participants (IFAD, 2019). The International Fund for Agricultural Development supports more than 30 community gardens in the Gambia, with several more to follow, enabling community members to cultivate a diverse array of nutritious foods and create additional income streams. It also reports transformational downstream benefits for the entire rural community—an indication that such programs are beneficial beyond urban environments.

A recent review of the impacts of urban green space demonstrated that such interventions carry positive health benefits, as well as "social and environmental outcomes, for all population groups, particularly those of lower socioeconomic status" (WHO, 2017b, p. 5), thus having a positive impact on health equity. The researchers suggest that the community should be engaged in planning and design at the outset to optimize outcomes, and equity should inform the design and be monitored following implementation. They also suggest that people of all ages who will use a green space be involved in its planning and design, and design

criteria should ensure that the resulting space is inclusive of and accessible to people of all ages. Given evidence that the design and maintenance of green spaces can mitigate health risks associated with living in urban areas, equitable access to green spaces is appropriately central to health-oriented urban planning and policies (Daniel, 2022). Indeed, Target 11.7 of the UN SDGs states that by 2030, countries should "provide universal access to safe, inclusive, and accessible green and public spaces, particularly for women and children, older persons, and persons with disabilities" (UN, 2022).

Walkability

While much of the 20th century focused on urban design accommodating cars, buses, or trains, cities around the world have recently focused on reorienting their design around people. Australia's Plan Melbourne centers on the ability of residents to meet most of their daily needs by traveling no more than 20 minutes from home by walking, cycling, or public transit (WEF, 2019). Walkability is the degree to which "the built environment enables the mobility of pedestrians" (Baobeid et al., 2021, p. 2). It is positively correlated with the health of an area's residents, and cities are increasingly recognizing walkability's benefits to individuals' health and to a city's energy and economy. But city living can pose challenges for older adults, because infrastructure is "typically designed for the working population to enhance efficiency and productivity," such as short street-crossing times and busy sidewalks with bike, scooter, and pedestrian traffic (Loo et al., 2017, p. 812).

High walkability of an area is beneficial for people across the life course, from children to older adults, and numerous relationships have been found across countries between walkability and physical activity levels (Sallis et al., 2016). Spanish researchers, for example, found that older adults living in highly walkable neighborhoods of Barcelona made more trips and spent more time walking relative to their counterparts in less walkable neighborhoods (Marquet and Miralles-Guasch, 2015). But motivations for mobility, especially among older people, often go beyond physical activity to include access to social support from family members and community networks (Gorman et al., 2019).

Overall, across 19 studies published in English or Chinese, walkability was found to have a preventive effect for diabetes, obesity, and hypertension, as well as dementia, for which diabetes is a risk factor (Cheng et al., 2012). One analysis, for example, found higher walkability to be associated with a lower prevalence of diabetes and obesity in 8,777 neighborhoods in Canada (Creatore et al., 2016). Given that physical activity has a direct correlation with physical health and can indirectly impact social engagement, developing neighborhoods and communities that support walking by individuals of all ages can enable healthy longevity. Even benches that allow people to sit and rest can make a difference for both parents with young children and older adults (WHO, 2022b).

More than half of the world (55 percent) lives in urban settings, and by 2050, that proportion will increase to 68 percent (UN, 2018). The United Nations reports that meaningful sustainable development will be critical in low- and middle-income countries, where the pace of urbanization will be especially rapid. Urbanization has played a key role in shaping human interaction, infrastructure, and living styles. With this increase in urbanization in recent years, it is even more important for cities to develop sustainable and feasible transit solutions for residents in ways that encourage community interaction and connection. At the same time, intentionally designing roads and sidewalks for improved walkability is taking place in many locations, with important benefits for people of all ages. The neighborhood of Yonsei-ro in Seoul, South Korea, for example, undertook a transformation that involved widening sidewalks at bottlenecks and developing more connections to subways, public squares, and shopping malls (Kaw et al., 2020). Consequently, the number of traffic accidents was reduced by more than 50 percent in the year following implementation, and the number of visitors increased by nearly 29 percent.

Safety

Safety, which promotes healthy longevity, includes reducing risks of becoming a victim of crime, being injured as a pedestrian, and falling. As with so many other aspects of healthy longevity, people with lower versus higher incomes are less likely to live in safe environments. Public spaces in low-income areas are often unsafe for reasons that range from increased traffic exposure to elevated crime rates. Safety in public spaces is relevant for all people but is particularly important for older adults, who are especially vulnerable to feeling unsafe and less likely to be mobile than younger people. Even if physical infrastructure such as roads and sidewalks is present, older adults will not be as active as needed to benefit their health if they do not feel safe going out.

A recent qualitative study of older adults living in a high-crime neighborhood, for example, found that many reported feeling "trapped" in their apartments, which directly affected not only their physical activity but also their ability to create and maintain social relationships (Portacolone, 2017). In a study of senior housing in Stockholm, researchers found that all criminal incidents described by residents of senior housing took place near their housing (Ceccato and Bamzar, 2016). It is important to note, however, that location and cultural context influence perceptions of crime among older adults. In South Africa, for example, 65 percent of older adults reported feeling unsafe on the street, compared with only 9 percent in Ghana (Lloyd-Sherlock et al., 2016). The effects of crime on fear have a strong association with mobility beyond the home. Where older adults fear crime, they are less likely to leave their home, limiting the physical activity and social connection that promotes healthy longevity.

Leveraging Opportunities for Community Design

While redesigning cities to improve public infrastructure and add various elements can be resource-intensive and time-consuming, the occurrence of a disaster, small or large in scale, offers an opportunity to return to a "better normal," provided that aspects of safe housing, green spaces, walkability, and social cohesion are incorporated into recovery planning before a disaster occurs. Following the 2012 earthquake and tsunami affecting eastern Japan, for example, authorities and private-sector businesses partnered to redesign a more resilient public housing community, detailed in Box 5-3.

Levers for Empowering Change

"Given the complexity of the built environment, understanding its influence on human health requires a community-based, multilevel, and interdisciplinary research approach" (Srinivasan et al., 2003, p. 1446). Many international reports call for efforts similar to those proposed in this report, and considering these reports in concert and not in competition can maximize the effect of interventions. For example, WHO's Global Network for Age-friendly Cities and Communities, established in 2010, seeks to stimulate and enable cities and communities around the world to become increasingly age-friendly (WHO, 2022b). It provides con-

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BOX 5-3
Case Study: Tago-Nishi Disaster Resilient Community

After the earthquake and tsunami that hit the eastern coast of Japan in 2012, authorities in Sendai City, one of the areas most devastated by the tsunami, set out to create a more resilient public housing resettlement area for people of all ages. Tago-Nishi was created as a model eco-town, with its own energy management system to supply the community center with power in the event of blackouts. In addition to built-in countermeasures for utility shortfalls, the town design included renewable energy sources, and smart grid systems provided by public–private partnerships.

The Open Village Nokishita community complex was included in the design as an easy place for community members of all ages to gather. "The facilities … planned for this 4,200-square-meter site around a courtyard were: a group home and short-stay facility for people with disabilities, a consultation and support office, a café and gallery to provide job assistance to people with disabilities, and a collective space and private nursery school" (Sekisui House, 2021, p. 74). This portion of the town opened in May 2019, with a focus on healthy urban development through connections and functions.

SOURCES: ESCAP, 2012; Hashimoto et al., 2015; iKaaS, 2022; Sekisui House, 2021.

nections between cities and communities to enable the exchange of information, assist in identifying innovative and evidence-based solutions, and offer a global database of age-friendly practices that members can access.

Individual choices regarding mobility are shaped by the built environment. Urban and transportation planners can create well-designed, mixed-use, compact cities of the future wherein trip length between origins and destinations is short enough to promote active travel (e.g., walking and cycling). Pedestrian-friendly infrastructure—tree-lined streets, quality sidewalks, supportive bus stops (e.g., with benches), traffic aids at crossings, and crosswalks—has the potential to improve perceptions of safety in neighborhoods. Intentional incorporation of evidence-based factors that promote well-being in the design of holistic physical environments can support healthy longevity for all people, including older adults, as described in Vision 2050 (see Chapter 2).

> Finding 5-3: Intentionally designed public spaces and built environ-ments can play an important role in influencing healthy longevity. Cre-ating opportunities for mobility, walkability, access to green space, and social engagement can enhance the lives of older people and reduce mortality and morbidity.

> Finding 5-4: Public infrastructure, such as sidewalks, bike lanes, and well-lit streets, can influence the usability of an area and adults' per-ception of safety. Interventions can facilitate more active travel, such as walking and cycling, and reduce sedentary behavior.

> *Conclusion 5-3: Opportunities exist to translate evidence into action in designing public spaces and infrastructure to promote social cohesion and intergenerational connection, thereby improving health outcomes and enhancing the lives of older adults.*

Metrics

Again considering the SDGs and the efforts that have been made to achieve them over the past several years, Target 11.7 specifically focuses on universal access to safe, inclusive green and public spaces. The corresponding indicator can help inform progress toward this target (UN, 2022):

- Indicator 11.7.1: Average share of the built-up area of cities that is open space for public use for all, by sex, age, and persons with disabilities.

Additionally, as the importance of walkability for a city or community has become increasingly recognized, measuring walkability and understanding factors

that may impact the mobility of older adults is also important. Accordingly, Alves and colleagues (2020) have proposed a Walkability Index for Elderly Health, which associates the adequacy of public spaces for older adults with the physical health benefits of walking. This index also can help urban planners and the general public identify age-friendly walking routes that take older adults' needs into account while also providing access to the amenities that young people and families are seeking.

Research Questions

Generally, the return on investment for various interventions related to age-friendly cities and improved public infrastructure needs to be better understood. This will enable government leaders at all levels to select the right set of interventions for their culture and context. For example, what is the impact on elements of healthy longevity of introducing bike lanes, or safe streets, or park benches? Another area that could benefit from greater understanding is how best to link age-friendly efforts around the world to existing urban policies and design changes being implemented in cities and countries (van Hoof et al., 2021). Some researchers have also asked whether the established standards for age-friendly cities are outdated and should be reconsidered, given technological advances and new agile approaches to design.

Experts note the importance of codesigning interventions with intended older adult users to learn and share knowledge and experiences at the individual and municipal levels. At the same time, translational research is needed to ensure that the findings of such efforts are generalizable and applicable in real-world settings. Codesigning future studies and translating research into practice will ensure that the right stakeholders are being engaged in the design process to accelerate insight.

KEY TARGET: TRANSPORTATION

Adequate transportation, or the lack thereof, has significant impacts on people of all ages. Transportation encompasses public transit—buses, trains, subways, and light rail—and travel by personal, shared, or hired cars (e.g., taxis or rideshare). Limited transportation options can have impacts ranging from impairing a person's ability to stay engaged in the community to impeding access to needed health services, which clearly has negative effects on health, especially for those residing in remote neighborhoods (Syed et al., 2013). People's access to multiple transportation modes can be limited by their financial resources as well as by inadequate infrastructure. However, new designs and innovations can positively impact the physical environment within a community, often at reasonable cost, to promote healthy longevity as people age and depend on different transport methods. This section explores how public transit, driving, and automated vehicles may improve healthy longevity.

Public Transit

As one of the most widely used forms of transportation worldwide, public transit is widely accessible across income levels because it does not require an up-front cost to purchase a vehicle or the ability to drive. In 118 countries, there are fewer than 200 vehicles per 1,000 people (NationMaster, 2022), emphasizing the critical nature of public transit. Public transit has particular importance for those living in low- and middle-income countries and for people with low incomes living in high-income countries who depend on public transportation and walking to meet their needs.

In addition to being carbon-efficient and accessible, public transit systems generally require physical activity (walking, climbing stairs) for access to stations or transit stops. A longitudinal study of adults aged 40–69 in the United Kingdom found that people who switched from commuting by active or public transit to commuting by car experienced increases in body mass index (BMI), while those who switched in the reverse direction saw decreases in BMI (Flint et al., 2016). Well-designed public transportation can support mobility across the life course, especially for people of all ages with physical disabilities.

However, there are numerous challenges to widespread availability and use of public transit. These include geographic disparities in stations, which influence equity within a city and may increase the distance of first- and last-mile travel to and from those stations for those who live in less favorable neighborhoods. Public transit is also less available outside of urban areas and can be difficult to access for those with physical or cognitive disabilities. Interventions that make public transportation more accessible to older people and others have been piloted and implemented in multiple countries. A transportation welfare project in South Korea, for example, targets rural areas that lack public transit and charges the equivalent of just USD0.09 for a taxi ride (Sang-Hun, 2021), an approach that addresses the "first mile–last mile" challenge for older adults who had a long walk to and from a bus or train stop. Authorities found that the program enabled people in remote villages to travel outside their village twice as often as previously. Similarly, the Freedom Pass in London, which allows free access to extensive public transport for older citizens, was found to provide access to goods and services (Green et al., 2014). As a way to tackle chronic loneliness, bus travel provides a sense of belonging and visibility, as well as opportunities for meaningful social interaction. Thus, where good public transit is widely available and not stigmatized, it can be a major contributor to well-being. Other examples include

- the addition of bicycle lanes and bus rapid transit within urban environments (Stankov et al., 2020);
- free bus passes to increase use of public transit among older people (Webb et al., 2016); and

- shareable mobility scooters for city residents with long distances to walk between their homes and public transportation, addressing first- and last-mile challenges (Portland Bureau of Investigation, 2020).

Driving

Driving is a common mode of travel for older people, especially in high-income countries, where it is the most prevalent mode of transportation among more affluent older people. In contrast to other modes of transportation, it has negative consequences, such as pollution and congestion (Green et al., 2014). For many older adults, driving allows them to spend more time away from home, stay engaged in their communities, and score higher on measures of successful aging (Houser, 2005). But, driving is not an equitable form of transportation. In Los Angeles, low-income older adults residing in inner-city neighborhoods have lower access to private vehicles relative to more advantaged population groups (Loukaitou-Sideris et al., 2018).

Moreover, driving is not always an option as people continue to age. Among older people, reduced functional capacity associated with sensory and musculoskeletal deficits can force older people to stop driving. "[O]lder men and women, ages 70–74, could expect to not be driving and instead be dependent on alternative transportation for the last 7 to 10 years of their lives, respectively" (O'Neill et al., 2019). When older people stop driving, their mobility decreases when they lack other transportation, with negative effects on their health. A systematic review found driving cessation to be associated with greater rates of mortality and depression, as well as premature admission to assistive-care facilities (Chihuri et al., 2016). Pooled data from five of the studies linked driving cessation with nearly double the rate of depressive symptoms in older adults.

Autonomous Vehicles and Other Emerging Solutions

Emerging technologies such as autonomous vehicles (AVs) will likely play an important role in meeting the growing demand to support the travel needs of an increasing older adult population. Once AVs are broadly available and their safety issues resolved, they have the potential to significantly improve the ability of older adults to travel around their communities (Harper et al., 2016; Shergold et al., 2015). Studies have highlighted reluctance to use AVs among older people, a tendency that increases with age (Becker and Axhausen, 2017). Training and awareness programs targeting older adults may help overcome reluctance. Shared AVs may provide a good option for neighborhoods that are designed for aging in place and have higher proportions of older adult residents (Carnemolla, 2018).

Like housing, discussed previously in this chapter, emerging AV technologies can be made more friendly for older adults through incorporation of such aspects of universal design as low-floor vehicle designs for easy entry, comfortable seat-

ing, automated journey planning, and the use of audio-visual technologies (Metz, 2000). In addition, integrating currently older people or "future elders" into the design process can ensure consideration of the unique needs of the aging population throughout the conceptualization, prototyping, and validation of AV designs. In addition to AVs, next-generation assistive technologies can support mobility and active lifestyles for older individuals, enabling them to travel both within and beyond their neighborhoods and communities (Marston and Samuels, 2019).

Other potential solutions involve interdisciplinary approaches. As the older population continues to grow, more than 80 businesses in Japan have devoted themselves to the principle of Mobility as a Service transport, which allows for shared ride services in addition to other options through a smartphone app (Doi, 2021). Most of these options are focused on operating in rural regions of Japan with less access to established mass transit infrastructure. In Shobara, a depopulated town in the mountains, new bus stops have decreased the distance older adults must walk to reach a stop. To make this system viable, the town has introduced smaller vehicles and a reservation system to reduce unnecessary use (Doi, 2021).

Levers for Empowering Change

Many opportunities exist to incorporate designs friendly to older adults in transportation systems, whether based on individual driving or public transit. Options include universal design in cars; innovative design of railways and buses that allows older adults to board, alight, and be seated more comfortably; installation of bus shelters, benches, and street lighting at transit stops and stations; and provision of mobility aids for crossings at bus stops (to enhance perceptions of safety). The frequency of services for multimodal linkages can be optimized, and the accessibility of point-to-point services can be enhanced. In addition to increased provision of public transportation links, rideshare companies such as Uber and Lyft, where available, have revolutionized point-to-point transportation for older people, and these services can also be augmented by such innovations as mobility scooters and reservations for specialized routes. These options can address some of the first- and last-mile gaps in public transportation. Finally, economic incentives in the form of travel subsidies have been shown to increase use of public transit.

Finding 5-5: Safe and accessible transportation options can give older adults the opportunity to enjoy independent mobility around their community instead of avoiding social activities and becoming isolated and lonely. In areas where public transit does not meet the last-mile needs of the population, such innovations as rideshare programs and autonomous vehicles are opportunities to increase safe mobility for older adults.

Conclusion 5-4: As older adults begin to make up a larger percentage of populations, countries and cities need to enhance available transpor-

tation options other than driving. Public transit systems would benefit from older adult–friendly designs and augmented first- and last-mile opportunities to ensure that people of all ages are able to maintain their independence and mobility.

Metrics

UN SDG Target 11.2 is related to transportation, so using the corresponding indicator of progress can help cities think about ways to advance efforts toward these goals (UN, 2022).

- Indicator 11.2.1: Proportion of population that has convenient access to public transport by sex, age, and persons with disabilities.

For additional metrics to consider, McKinsey & Company developed elements of success in 2021 after studying the transportation systems in 24 cities across the globe (Knupfer et al., 2018). They selected five aspects of transportation systems for comprehensive assessment: availability, affordability, efficiency, convenience, and safety and sustainable development. For example, availability includes such indicators as the share of the population or workplaces living or located less than 20 minutes' walking distance from a railroad station, or the number of bicycles used in public rental systems per million people. Indicators for safety and sustainability include such measures as the number of public-road traffic accident fatalities per million people per year, or the concentration of nitric oxide in the air in molecules per cubic centimeter.

Research Questions

With respect to transportation, much research has been directed at mobility options and building of mobility environments that are accessible for older adults, but how legislative and institutional approaches to providing various transport options are best used remains unclear (Lin and Cui, 2021). The latter findings could be paired with findings on the optimal combination and use of policies to promote equity and social inclusion for a more synergistic impact.

KEY TARGET: DIGITAL TECHNOLOGIES

In the 21st century, access to digital communications is imperative for all people. Interactions with businesses, health care systems, and educational institutions are now built on an internet foundation. Many of the advances described in this and the earlier chapters in housing, social engagement, and transportation are also contingent on access to reliable internet and familiarity with digital devices. The COVID-19 pandemic highlighted the importance of internet-based communication within families and social groups at a time when in-person gathering was deemed

unsafe. Unfortunately, inequity in access to modern, high-speed internet across populations is significant (Garcia-Escribano, 2020). One area of inequity is the pronounced digital divide between older adults and other age groups. "The UK Office of National Statistics estimated that in 2020 around 92% of the population as a whole used the internet, compared to only 54% of people aged 75 years or older" (*The Lancet Healthy Longevity*, 2021, p. E601). For older adults, the adoption and use of internet- and other technology-based systems is influenced by the availability of broadband internet and also by discomfort with using technologies that did not exist during most of their adulthood (see Chapter 4). Considering the intended users of digital technologies during the design and development process and jointly designing systems with users will improve usability to older people and support efforts to reduce ageism, health inequities, and the digital divide.

A digital technology access divide also exists between high- and low- and middle-income countries. The World Bank reports that only 50 percent of the population in low- and middle-income countries uses the internet, compared with 89 percent in high-income countries (World Bank, 2022). Public- and private-sector involvement is imperative to improving access, including cost reduction, which will be necessary for technology to support the achievement of healthy longevity.

Broadband Access

Access to high-speed internet is integral to a functioning society today, and thus is an essential component of infrastructure. While researchers and policy makers appear to understand the extent to which broadband benefits health and equity, disparities remain in access to the technology. "From economic stability, to education, to social supports, to civic agency, broadband and the digital services it enables are intrinsically tied to collective health and equity outcomes" (Tomer et al., 2020, p. 3). The World Bank has estimated that in 2019, more than 56 percent of the world's population was using the internet, but only 1.2 billion people, or 15 percent of the world's population, had fixed broadband subscriptions (World Bank, 2022). According to the latest research in the United States, 38 percent of households earning less than USD20,000 per year lack a broadband subscription, a gap that greatly impacts equitable access to and adoption of mobile health technologies and other online systems (Sieck et al., 2021). Rural areas are notably unable to access reliable broadband internet services. "For example, while broadband use in the capital cities of India, the Kyrgyz Republic and Moldova and are at the same level as some Organization for Economic Co-operation and Development (OECD) members, usage in these three countries' rural areas is among the lowest in the world" (World Bank, 2021).

Reliable internet access also impacts multiple aspects of life. During the COVID-19 pandemic, reliable access had far-reaching effects on a person's ability to access mobile health technology, work in office settings, continue education during remote learning, and stay connected to social networks. Investments in broadband impact the economy, with one study showing that doubling broadband

speed can result in a 0.3 percent addition to gross domestic product growth, and even more modest increases in speed can positively impact household incomes in middle- and high-income countries (Ericsson et al., 2013). Katz (2009) found that if 12 Latin American countries were to add 11 million broadband lines, it would generate at least 378,000 jobs (Katz, 2009).

The digital divide in access to infrastructure is seen within and across countries. The International Monetary Fund (IMF) has noted that this is also the case for businesses in different regions of the world. Only about 60 percent of businesses in sub-Saharan Africa use email, compared with 85 percent of businesses in Europe and Asia (Garcia-Escribano, 2020). Many disparities exist in the United States:

> The majority—13.6 million—of digitally disconnected households across the United States live in urban areas, but the gaps in rural areas are an even larger share of the total rural population. Researchers consistently find those least likely to have broadband in America are communities of color and low-income communities, suggesting that systemic barriers remain in place. (Tomer et al., 2020, p. 4)

Even when rural areas have broadband access, they often face slower speeds, potentially limiting economic growth. Box 5-4 outlines examples of opportunities for increasing access to broadband.

BOX 5-4
Case Study: Equitable Access to Broadband

Unfortunately, gaps in "broadband availability are a natural offshoot of the privately owned and privately financed industry model" prevalent in many countries. "Improving broadband's physical reach will require interventions that either incentivize private capital to invest in riskier geographies, allocate public funding to the construction of public networks, or some mix of the two." All levels of government can contribute to these kinds of interventions.

Municipalities and national governments can also use their "current capital assets to fill network gaps via targeted wireless services," a strategy that has proved especially important during the COVID-19 pandemic. "This includes: the use of libraries, schools, and other public buildings to broadcast accessible, 24-hour wireless networks; the use of vehicles, such as school buses, to create mobile hotspots, including during nonoperating hours; and installing wireless access points in public parks, light poles, and other public spaces." These interventions are especially important in neighborhoods where network service is unavailable or simply unreliable. Public access points can be impactful in low-income neighborhoods and communities of color, where residents may not have in-home or wireless subscriptions.

SOURCE: Adapted from Tomer et al., 2020.

Information and Communications Technology

Information and communications technology (ICT) systems include the components, devices, and systems necessary for organizations and individuals to interact in the digital world. The proliferation of these systems over the past decade has created opportunities for improving the lives of older adults, ranging from improved social connections to health care augmentation (described more in Chapter 6). In an Israeli study of adults aged 65 and over, for example, researchers found that individuals who used computer-based applications, such as web pages and real-time chat rooms, reported a lower level of loneliness compared with nonusers (Pearlman-Avnion et al., 2020). Another example is the European Union-funded project Eldergames, which was initiated to reduce the natural process of cognitive decline associated with aging (Gamberini et al., 2008). The study found potential benefits of cognitive training performed via videogames offered by the older adult game system. Other similar findings indicate that videogame platforms paired with cognitive training can help reduce cognitive decline and depressive symptoms for those with mild Alzheimer's disease (Fernández-Calvo et al., 2011).

While less common than computers, interactive robotic systems have been developed to assist older individuals with their mental and physical needs. For example, PHAROS—a robotic system developed to enhance older adults' physical activity by recording their exercise performance, categorizing the exercise performed, and recommending physical exercise periodically—showed high accuracy of exercise detection among its older users (Costa et al., 2018). Several studies have examined the benefits of socially assistive robots for older adults. The use of robotic animals as therapy for patients with severe dementia avoid the potential negative health effects of real animals, such as allergies and infection (Hung et al., 2019). However, experts have raised ethical concerns about the use of robotic applications for older people. Unresolved issues "include a potential reduction in human contact; an increase in feelings of objectification and loss of control; loss of privacy and personal liberty; and tendencies toward deception and infantilisation of older people" (Share and Pender, 2018, p. 51). These ethical concerns need to be considered from the design stage.

Privacy, Cybersecurity, and Usability Concerns

An additional concern with regard to digital technology is online privacy, "understood as a person's right to be protected from unauthorized disclosure of their personal information when online, and from unauthorized publicity, scrutiny, use, or surveillance of their digital information or activities" (Quan-Haase and Ho, 2020). Cybersecurity threats—criminal activities carried out via computers or the internet—remain a concern as more older adults using digital devices increases the number of people at risk (Age UK, 2015). Americans over the age

of 50 reported more than USD1.8 billion in cyberfraud losses in 2020, nearly 30 percent higher than losses in 2019, and the same age group also saw a 61 percent increase in cybercrime complaints that same year (FBI, 2020).

Older adults are targeted by multiple types of fraud for reasons including cognitive decline, social isolation, and lack of knowledge regarding fraud prevention (Shao et al., 2019), especially when using the internet with a limited understanding of the technology. Qualitative interviews in India found that cybercrime had profound impacts on older adults, who often lost their life savings or money set aside for emergencies. As a group in which the majority are not working, older adults are also less able to recoup such losses, and they become even more wary of technology (Tripathi et al., 2019). Researchers suggest that older people need the skills, awareness, and tools to understand when and how to share private information, while frontline staff in banks and law enforcement agencies need training to support these victims when such crimes do occur.

Still another concern relates to older adults' lack of confidence in comprehending or accessing digital devices that result from inadequate user-centered design of software and hardware interfaces (Wang et al., 2019). The decline in visual acuity that commonly accompanies aging impedes the use of ICT if visibility enhancement features are lacking or of poor quality. Furthermore, modern software interfaces and internet platforms require incremental updates and iterations to adapt to user preferences, resulting in fluid interfaces that transform without warning, often rendering previous user knowledge irrelevant (Wang et al., 2019). Designing digital interfaces that account for the limited functional ability common among older adults, along with instructional material clearly explaining the steps needed to access functionalities, could help overcome some of these limitations.

Interventions to Improve Access to and Use of Digital Technologies

While all countries will need to balance trade-offs when implementing programs to narrow their own digital divides across generations, an analysis focused on countries in Latin America highlights seven key elements that should be included in any new efforts (see Box 5-5).

Levers for Empowering Change

Whether through expanded broadband access, videogame platforms, interactive robots, or use of technology in everyday life to access transportation, evidence shows that narrowing the digital divide between older and younger generations can have positive effects on quality of life, connection to social networks, and healthy longevity. To realize the goals of Vision 2050, however, these advances need to be delivered with equity as a central focus, ensuring that disparities in access are not worsened across various groups or countries. To

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BOX 5-5
Elements to Consider When Implementing Policies and
Programs to Narrow the Age-Based Digital Divide

A study on the digital divide in Latin America concluded with the recommendation that countries seeking to decrease the digital divide consider the following:

1. "Strengthen the coordination among the different public sector, private sector and civil society entities that organize programmes to promote ICT usage among older adults to ensure that the programmes are mutually reinforcing.
2. Promote intergeneration skills development, whereby the younger generations assist older adults in becoming familiar with digital tools that are of use to them.
3. Promote opportunities for peer-to-peer training, where older adults who are actively engaged in the digital society help to train older adults who have not yet embraced digital technologies.
4. Develop apps or other technological tools that respond directly to older adults' needs have and that can foster their inclusion in society and raise awareness on these technologies among older adults.
5. Expand access to the Internet in the home or via mobile devices for older adults, particularly for those residing in rural areas, those belonging to indigenous groups and those of low socioeconomic status. Improve data on ICT usage at the individual level—as this analysis reveals, few countries in the region have data that can be used to measure ICT usage among older adults, which makes it difficult to identify patterns and monitor policies.
6. Ideally, qualitative data should also be used, as they could further understanding of the barriers and factors that promote ICT use among older adults in Latin America and the Caribbean and provide insight on the most relevant issues that condition the use of ICT by this population (low levels of literacy, non-accessible formats, cost, lack of familiarity, individual perceptions of ICT, among others).
7. Promote greater participation of older adults in ICT development so that these tools better meet their needs and promote participation in the drafting of plans and strategies to expand ICT access and use among older adults."

SOURCE: Sunkel and Ullmann, 2019, pp. 232–233.

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support affordable and universal access, for example, IMF suggests ensuring that internet investments are complemented by universal access to electricity and subsidies for groups that might otherwise not enjoy access to those investments (Garcia-Escribano, 2020).

Concerns about the expanded use of technology among populations that are largely unfamiliar with hardware and software can be expected to persist. Due diligence with respect to protecting privacy and preventing cybersecurity threats needs to be part of this continued expansion. Given the increasing age of retirement in many high-income countries, retirement benefit packages can teach vulnerable older adults cybersecurity practices related to the use of ICT and online

services and transactions. Similar training programs need to be made available for economically inactive vulnerable retirees to protect them from online scams and predators. Similarly, it will be important to equip future software technologies with fail-safe designs that can identify vulnerable users and implement extra layers of protection accordingly to minimize cybersecurity vulnerabilities.

> Finding 5-6: Access to broadband internet is integral to many aspects of society. Low-income and rural households are especially likely to lack broadband access, which greatly influences their equitable access to other resources and their ability to work remotely and stay connected to social networks.

> *Conclusion 5-5: Broadband is essential infrastructure for achieving Vision 2050. Improving broadband access across socioeconomic demographics will require a combination of public and private incentives and investment. Increased attention to user-friendly functionalities for older adults and additional instructional support need to accompany these investments to ensure equitable access.*

Metrics

The UN SDG indicator for Target 9.c is specifically related to measuring the access to ICT in all countries (UN, 2022):

- Indicator 9.c.1: Proportion of population covered by a mobile network, by technology.

Another useful indicator for digital access could be whether a country has policies in place that promote inclusive and equitable digital access for older adults. In virtual health care, for example, many countries managed to scale access to those services but often to the detriment of underserved groups (including older adults) unless a specific policy to ensure their inclusion was in place.[2]

Research Questions

As technology advances (e.g., introduction of 5G wireless), research into who is using ICT systems and how they are using them will be important to support public–private partnership investment decisions. Research also has the potential to identify the factors that influence the adoption of digital systems by

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[2] Personal communication with Ann Aerts, Novartis Foundation. Broadband Commission working group on Virtual Health and Care, chaired by Novartis Foundation and WHO (report to be released June 4–5, 2022).

users in general, with specific attention paid to older adults. The advancement of knowledge can then be used to further improve these systems through the design process and by introducing appropriate training to support their broader adoption.

Given the association between lack of connectivity among older adults and other adverse social determinants of health, understanding how to steepen the technology adoption curve for older adults can help inform insight into ways of advancing healthy longevity. Implementing programs and then evaluating changes in organizational capacity across senior centers, libraries, nonprofit organizations, and long-term care facilities and their partnerships with industry and government can guide future action to facilitate the adoption of technologies among older adults (OATS, 2022).

While COVID-19 demonstrated how rapidly some services could be shifted online, it remains unclear how technologies affected access to health and social services for older adults. An umbrella review encompassing more than 100 studies found none that examined technologies used to facilitate first-contact access to care, and the researchers argue that more research is needed to understand both positive and negative consequences of this online shift for care access and identify those most likely to be excluded (Kunonga et al., 2021). Additionally, authors of a study in South Korea suggest that future research should focus on developing standards for understanding the digital divide in smart environments, not limited to PC-oriented environments, given the explosion of smart technologies over the past decade (Jun, 2020).

KEY TARGETS: CLIMATE CHANGE AND ENVIRONMENTAL HAZARDS

Climate change is an existential threat to all people, regardless of their age. The ongoing impacts of climate change constitute an urgent environmental challenge, as healthy longevity is not possible without a healthy planet. Recent studies predict that the frequency of extreme weather events will increase over the next three decades, with effects across the life course but disproportionate and near-term adverse effects on older people (Gamble et al., 2013). In addition to climate change, environmental stressors such as exposure to air pollution have greater adverse health effects on older people, particularly those already suffering from respiratory illness (Simoni et al., 2015). Health-promoting physical environments can enable healthy longevity throughout the life course, yet across the globe, factors in the current built environments in many urban and rural settings pose multiple barriers to, and opportunities to improve, healthy longevity (see Figure 5-3). These factors will become increasingly important as threats due to climate change increase in frequency and severity. Key components of the environment impact healthy longevity, either positively or negatively, at all levels. Figure 5-3 shows that the effect of the built environment on health and well-being does not occur on a single societal level. As discussed in Chapter 4,
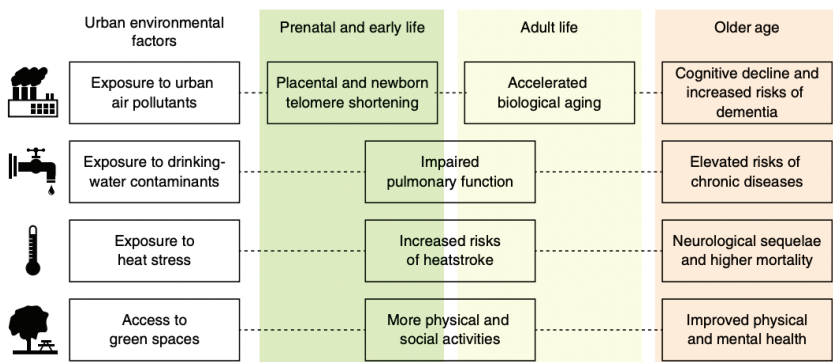
FIGURE 5-3 Examples of factors in the urban physical environment and their potential impacts on healthy longevity.
SOURCE: Reprinted by permission from Springer Nature, *Nature Aging, Rethinking the urban physical environment for century-long lives: From age-friendly to longevity-ready cities,* Wang et al., 2021.

many of the key factors shown in this figure align with the UN SDGs, which also support healthy longevity. Successful solutions will require initiatives that, like the SDGs, bridge all levels of societal action and synergistically affect an individual's health trajectory.

Climate change promises to intensify exposures to extreme weather events and more extreme temperature variations. These changes, in part, can also contribute to increased opportunity for infectious disease spillover from animals to humans and increasing incidence of new diseases in regions where they have previously not been endemic. As Rodó and colleagues (2021) point out, "climate change can both facilitate zoonotic spillovers and have an effect on transmission chains" (p. 576). In addition to COVID-19, several other infectious disease outbreaks occurring in recent decades have been due to spillovers from animal populations to humans. Climate change is believed to play a role by altering species' range and density, in addition to increasing urbanization and crowded living situations in many countries, all of which affect human exposure to these diseases (Baker et al., 2021). To address this increasing globalization of health risks and to better understand and predict outcomes from the human–animal–ecosystem interface, many experts argue for a more comprehensive application of the One Health concept (Destoumieux-Garzón et al., 2018). Destoumieux-Garzón and colleagues (2018) describe One Health as a global strategy arising from the need for an approach that is "holistic and transdisciplinary and incorporates multisector expertise in dealing with the health of mankind, animals, and ecosystems" (p. 2). Effective surveillance and management of these new and reemerging threats to promote longevity among all populations will require "breaking down the

interdisciplinary barriers that still separate human and veterinary medicine from ecological, evolutionary, and environmental sciences" (pp. 1–2).

> Finding 5-7: The built and natural environments where people live affect their health either positively or negatively. Harmful exposures throughout the life course, such as exposures to heavy metals or cancer-causing chemicals, affect the speed of biological aging and timing of the onset of chronic conditions later in life. The consequences are amplified by the cumulative effects of multiple exposures.

> *Conclusion 5-6: Because environmental exposures and health are closely linked, countries need to take rapid action to reduce harmful exposures and increase opportunities for people to live in healthy environments. Efforts to reduce the level of cumulative harmful exposures across the life course are necessary to promote good health and make progress toward healthy longevity.*

Extreme Weather Events and Changes in Ambient Temperature

Extreme weather events caused by climate change have disproportionately adverse impacts on older adults. Migration due to coastal flooding, tsunamis, hurricanes and cyclones, and other extreme weather events often produce "climate refugees," and the phenomenon is increasing annually. Overlapping vulnerabilities, particularly for older people and those with disabilities, are exacerbated in humanitarian emergencies.

An analysis of the impact of ambient temperatures on years of life lost in low-, middle-, and high-income countries illuminates the systematic association of both extreme heat and cold with life expectancies (Watts et al., 2018). As the intensity and duration of heat waves increase, the risk to older adults will also increase, manifesting in both morbidity and mortality during heat waves. Susceptibility to dehydration and declining physiological homeostasis mean that extreme heat poses a considerable threat to the health of older adults (Schols et al., 2009). Additionally, older people are vulnerable to extreme events such as heat waves due to chronic conditions, and those with limited means may lack good ventilation or air conditioning systems. For older adults aged 65 and over living in São Paulo and Mexico City, for example, exposure to high mean apparent temperature (representing the temperature on the day of death) was associated with a higher risk of mortality (Bell et al., 2008).

Air Pollution

A growing body of evidence points to the association between air pollution and negative health effects. Findings suggest that even slight increases in

particulate matter linked to car emissions, soot, and smoke in both urban and rural areas are contributing to negative respiratory symptoms and early deaths among older adults (Friedman, 2022), as well as neuropathology and stroke, Alzheimer's disease, and Parkinson's disease (Block and Calderón-Garcidueñas, 2009). A recent study across the United States revealed that 18,000 older adult lives were lost prematurely from 2016 to 2018 as a result of particulate matter (Weinstock-Platzman, 2019).

Additionally, findings based on animal studies suggest that prenatal and early-life exposure to traffic-related air pollutants is associated with memory impairment, as well as mental and behavioral conditions such as depression. One study found that early exposure to air pollutants in Mexico City negatively affected cognitive functioning in children who had no additional known risk factors, compared with children living in a low-pollution region (Woodward et al., 2018). Adverse physical outcomes are seen as well, as older people in South Africa who lived close (1–2 km) to mine dumps, which have been shown to be associated with air pollution, were found to have significantly higher incidence of "asthma, chronic bronchitis, chronic cough, emphysema, pneumonia, and wheezing" (Nkosi et al., 2015, p. 1).

Interventions to Address the Effects of Climate Change

Recognizing this impact, many countries and cities have taken more intentional action to reduce their levels of air pollution. In Ghana, where nearly 12,000 people die from air pollution each year, city officials in the capital of Accra worked with Norwegian officials and local public health professionals to illustrate the links among air pollution, mortality, and health care costs, providing needed information to citizens on clean air policies (CCAC, 2021). The initiative has now garnered increased engagement from the Ministry of Transport for the use of health assessment tools and is continuing to expand knowledge of these linkages among health care workers. It also has raised awareness within communities of the need to reduce waste burning and develop green public spaces. Environmental staff in Ghana can now "continuously monitor particulate matter and black carbon in multiple areas of [Accra], and produce quality and reliable data to more accurately identify sources of air pollution" (CCAC, 2021).

Heat waves also represent an urgent concern for city planners and policy makers. Some cities offer centrally located cooling centers or provide air conditioners for those in need to keep older adults safe at home. Larger-scale efforts to reduce the impacts of heat in cities include the use of green roofs, water management, and open spaces. Mitigation efforts of Frankfurt, Germany, one of the country's warmest cities, are highlighted in Box 5-6.

BOX 5-6
Case Study: Climate Mitigation Efforts to Keep Frankfurt Cool

In 2018, Frankfurt, Germany, documented a record average annual temperature, due in part to the urban environment that made it much hotter than rural areas. The temperature in the inner city and rural outskirts can differ by as much as 10°C. Concrete absorbs heat, the numerous buildings reflect the sun, and the large number of people living in the city creates a great deal of warmth. Frankfurt has taken several measures to address this problem of rising heat.

One such effort entails the creation of ventilation corridors—stretches of land with no high buildings or areas dense with trees—so that cooler air can flow downtown. The ventilation corridor along the river Nidda is especially helpful in bringing colder air into the city during the summer.

The city of Frankfurt has also developed numerous green roof gardens, which insulate and cool buildings, save costs, and reduce noise, and the city now requires some new buildings to have a green roof. Frankfurt's airport has approximately 40,000 square meters of green roof space. The difference these green roofs make can be significant, with reports of typical black rooftops reaching more than 70°C, and green roofs staying below 30°C. In addition to reducing heat, green roofs can contribute to improving air quality by removing dirt particles from the air, directly benefiting nearby residents who suffer from asthma and other respiratory issues.

Finally, city planners have prioritized porous surfaces to decrease water runoff and allow evaporation to cool the streets. Some areas are even creating waterways to collect rainwater.

SOURCES: Wilks, 2020; Wright, 2020.

Levers for Empowering Change

As climate-fueled disasters grow in intensity and frequency alongside rapidly aging populations, governments need to develop systems for locating and evacuating vulnerable older people when necessary. In particular, technology-enabled alerts and plans can be used to monitor the status of and provide aid to older people. To this end, civil protection services often maintain registries of vulnerable older people. Additionally, the United Nations recommends best practices from several countries, including engaging older adults in preparedness and disaster risk reduction strategies, providing them with financial support and extended social protections following emergencies, and specifically developing recovery strategies geared toward reintegrating them into normal life following disasters (UN, 2020). Numerous examples during the past two decades have demonstrated the dire outcomes that occur when preparedness for vulnerable populations is not carefully carried out in advance.

The lack of global and robust response to climate change has also widened a divide between younger generations' galvanization around the climate crisis and the perceived inaction of older generations (Milfont et al., 2021). The commission agrees that collective action and solidarity with those most vulnerable to and affected by the consequences of climate change are needed. In the context of healthy longevity, extreme weather and changes in ambient temperature, along with air pollution, are among the most concerning and immediate environmental hazards requiring national and local attention.

Leveraging existing efforts and stakeholders and leaning on multilateral organizations can help countries and cities address the effects of climate change in their own contexts. The Climate and Clean Air Coalition, facilitated through the United Nations, brings stakeholders together across countries and sectors to improve air quality and protect the climate in the decades ahead.[3] The Coalition's focus is on rapid action to realize benefits across the areas of climate, public health, energy efficiency, and food security.

> Finding 5-8: While the impacts of climate change demand action for all populations around the world, older adults are often faced with overlapping vulnerabilities that make them especially likely to experience adverse events related to extreme temperatures, natural disasters, and air pollution. Older adults suffer some of the most adverse consequences of climate change and extreme weather events through exposure to air pollution, flooding, and extreme heat and cold waves. Studies across countries have found associations between high temperatures and increased risk of mortality and morbidity.

> *Conclusion 5-7: In their climate change planning and mitigation efforts, cities and countries need to consider the amplified impacts on older adult populations, as well as necessary monitoring and response actions. Systems for locating and evacuating vulnerable older people when necessary, as well as embedded designs in buildings and public spaces that reduce temperatures, could help augment other efforts.*

Metrics

In terms of metrics, UN SDG Target 13.1 is highly relevant to climate change and environmental hazards, and Indicator 13.1.3 can help measure progress related to climate emergencies (UN, 2022):

- Indicator 13.1.3: Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies.

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[3] See https://www.ccacoalition.org/en.

For tracking air pollution and its potential health effects within smaller regions or jurisdictions, WHO updated its global air quality guidelines (AQGs) in 2021. This update provides new recommendations on AQG levels and interim targets for $PM_{2.5}$, PM_{10}, ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide, and also ties the changes to reductions in health effects (WHO, 2021b).

Research Questions

While numerous studies have provided evidence that older people are more affected by climate change impacts, on average, relative to younger populations, older adults remain less amenable to making critical changes to reduce emissions and address other sustainability issues related to climate change. Research is needed to characterize the attitudes of older people on these issues and learn how they might be persuaded to engage in more "legacy thinking" (Frumkin et al., 2012), including potential levers for incremental attitude change and specific communication strategies for raising their awareness about climate change impacts. Finally, further research is needed to inform collaborative adaptation planning that would engage older populations with local governments and a broad coalition of partners in designing solutions to keep older people safe (Rhoades et al., 2018).

CONCLUSION

Countless studies around the world have demonstrated important linkages between various factors in the environment and the health of individuals and populations. Critical facets of everyday life can act as barriers to and facilitators of healthy longevity and can influence the length of time a person is healthy at any point along the life course, not just in old age. Many cities and countries have acknowledged these connections and are modifying their public services and urban designs to create opportunities for growing populations to live longer and healthier lives. But these changes need additional evaluation and implementation in varying contexts, especially in low- and middle-income countries, to advance understanding of how they can be optimized to have the greatest effect on achieving healthy longevity for all. The commission believes that to achieve the goal of creating physical environments and infrastructures that support functioning and engagement for older people, the key targets of housing, public infrastructure, transportation, digital access, and environment need to be intentionally designed, properly resourced, and shaped for healthy longevity.

> **Recommendation 5-1: Governments and the private sector should partner to design user-centered and cohesion-enabling intergenerational communities for healthy longevity. Initiatives should include**
> **a. at the city level, developing and implementing mitigation strategies to reduce the negative effects of the physical environment (e.g.,**

air pollution and climate events such as flooding and hurricanes/
typhoons) on older adults;

b. at the neighborhood level, promoting and measuring the impact of
   innovation and policy solutions for healthy longevity, intergenera-
   tional connection, and cohesion;

c. at the home level, updating physical infrastructure to address af-
   fordability, insufficiencies, and inefficiencies in housing stock, as
   well as support autonomy and social connection;

d. making broadband accessible and reducing the digital divide (e.g.,
   usability of and willingness to adopt technology) within the context
   of each community; and

e. designing public transportation options, including solutions that
   address first-/last-mile transportation needs, that can be provided to
   companies, foundations, and local governments for implementation.

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6

Health Systems

Before societies can reap the many benefits of healthy longevity discussed throughout this report, it will be necessary to maximize the percentage of life in good health. Accomplishing this will require a life-course perspective to minimize adverse exposures and promote health from the prenatal stage through the end of life. Prevention at the individual and societal levels will need to receive greater emphasis to decrease the burden of age-related chronic conditions.[1] The goals for health systems by 2050, key targets to catalyze change, and examples of structures needed to achieve the goals are shown in Figure 6-1.

As discussed throughout the rest of this chapter, no country has perfected any one of the three main health systems—public health, health care, and long-term care—although some countries do better than others. Few countries are well positioned to provide the prevention and care required to decrease the prevalence of chronic conditions and associated symptom burden and functional decline. Public health is chronically underfunded and lacks influence in other government departments that influence health, limiting its ability to improve population health. Health care systems have focused on diagnosing and treating chronic conditions one disease at a time, with entrenched policies that result in far more spending on in-patient care for advanced chronic conditions than on prevention. Long-term care is also underfunded and inadequately integrated with health and social care in many countries. Often, long-term care is not available where the person needing care wants to live.

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[1] As used in this report, the term "chronic conditions" encompasses distinct chronic diseases, multimorbidity, and geriatric syndromes (frailty, sarcopenia, polypharmacy, cognitive decline, disability, and falls).

173

Health Systems Key Targets

Chronic conditions; public health; health care delivery; long-term care; health care workforce; and geroscience, technology, and big data innovation

2022 - 2027

Recommendations for Next 5 Years

(full text at end of relevant section within Chapter 6)

6-1. Develop strategies to increase investments in robust public health systems

6-2. Shift health care systems to focus on healthy longevity

6-3. Make available culturally sensitive, person-centered, and equitable long-term care

2022 - 2050

Supporting Structures

All Health Systems
- Integration across public health, health care, long-term care, and social services

Public Health
- Interventions at population and individual level to reduce underlying risk factors for aging and chronic conditions
- Close collaboration with social service providers, workplaces, and other entities that can promote health
- Data and analytics systems for surveillance, precision public health, and assessment of the efficacy of interventions

Health Care
- Integrated person-centered care, including care coordination
- Primary care
- Comprehensive and shared health records and a goal-based care plan
- Collaboration with social services to address social determinants of health
- Primary care systems that provide preventive screening, address risk factors for chronic conditions, and promote positive health behaviors
- Geriatrics workforce that can adequately care for older people globally
- Palliative and hospice care

Long-Term Care
- Policy and funding prioritizes care delivery in the setting the person chooses, to the extent possible; respects individual autonomy and maintains dignity; and attends to care quality and the risk of abuse, neglect, and exploitation
- Care and social supports addressing all needs, including meaning and purpose
- Supports for families and family caregivers when providing long-term care while making formal care available when needed
- Technology to support caregivers and people needing care by providing monitoring that allows privacy

2050

Goals

7. Integrated public health, social service, person-centered health care, and long-term care systems designed to extend years of good health and support the diverse health needs of older people

8. Quality long-term care systems to ensure that people receive the care they require in the setting they desire for a life of meaning and dignity

FIGURE 6-1 Health systems roadmap.

This chapter provides background information on the health of older adults today, global health spending patterns, and the value of good health. It then describes key targets needed achieve healthy longevity, including chronic conditions, the roles of public health and integrated person-centered primary care in

providing prevention and management of chronic conditions, the long-term care system needed to support people who lose functional ability, and the health care workforce. The final key target is innovation through geroscience, technology, and big data to prevent and manage chronic conditions and maintain people's independence in the face of declining cognitive and physical functioning. The chapter concludes with an overview of related international efforts calling for similar actions, metrics that stakeholders can use to gauge progress toward achieving healthy longevity, and areas needing more research.

As with earlier chapters, commissioners selected key targets for action beginning in 2022 from the many factors affecting healthy longevity. Commissioners prioritized content based on actionability, impact on people across the life course, equity, and importance to (1) improving healthy longevity in the long term and (2) tackling needs of older people in the near term. They also identified actions to generate the multisector, all-of-society transformation essential to building healthy longevity for all. The commissioners chose not to focus on aspects of health systems that are on the agenda of other major international efforts, such as primary care and health care access and affordability, although they recognize their importance. The key targets that were selected will, in some instances, require major financial commitments. In other cases, such as emphasizing geriatric-sensitive care and delivering integrated, person-centered care, the investments should be feasible.

Given the diversity of political, social, and economic contexts across countries and communities, the commissioners chose broad recommendations that leave room for actors with the ability to improve healthy longevity to determine the right pathway and funding strategies, which will require trade-offs to move forward. In other instances, key targets would shift emphasis within existing structures, requiring political will and culture change.

VISION FOR HEALTH AND HEALTH SYSTEMS

The focus of interventions across health and social service systems changes from when people have good health and function to when people have advanced illness and functional loss. For those in good health and those with well-managed chronic conditions and minimal functional impairment, public health and health care systems focus on prevention, reversal, or management of chronic conditions, screening, and health promotion. Social and physical environments for this subpopulation should facilitate engagement and activity. For those with advanced illness and significant functional loss, health care focuses on management of advanced chronic conditions while long-term care focuses on compensating for loss of function and promoting engagement in a life with meaning and purpose. For this subpopulation, social and physical environments should remove barriers to participation and compensate for functional loss.

MEASURING HEALTH

To fully understand healthy longevity, data that directly measure poor health and its impacts on people, including functioning and symptom burden, will be critical. Direct measurement of disability in population-based studies and clinical care involves the individual's self-report of difficulty or dependency in tasks of mobility, activities of daily living (ADLs), independent activities of daily living, and objective performance-based measurement of various dimensions of functioning (e.g., walking speed for physical function, and memory and recall for cognitive function). Most disability results from biological aging, alone or in concert with chronic diseases, cognitive decline, and frailty. Symptoms such as pain, shortness of breath, and fatigue can sometimes affect function, but they can also affect quality of life without major functional impairment; they require direct measurement as well. The degree to which symptoms are included in the measures described below is unclear.

Mortality is a primary outcome measure for health, but it becomes less relevant as people move closer to inevitable death. While death that occurs because a condition is undiagnosed or poorly managed is important, it is captured within the World Health Organization's (WHO's) Global Burden of Disease estimates only for people under age 70.[2] Similarly, the United Nations (UN) Sustainable Development Goals (SDGs) use the same cutoff of age 70 for premature mortality (Ebrahim et al., 2020).

Assessing the health burden of chronic disease currently relies on indirect measures. One measure is the presence of a specified number of chronic conditions. Although the presence of chronic conditions is related to disability and mortality over time, people can live with well-controlled chronic conditions for long periods with minimal symptoms or other impacts on life, so it is an imperfect measure of the burden of illness. Since the early 1990s, WHO has sought to measure the burden of poor health using two related measures: years of healthy life lost due to disability (YLDs) and disability-adjusted life years (DALYs). These measures are critical to WHO's ongoing effort to "define, measure and numerically value time lived in non-fatal health states." The numeric values are calculated using disability weights between 0, a state equal to death, and 1, perfect health. Disability weights are used to measure YLDs, which are combined with years lost to premature death (a figure that excludes people over age 70) to calculate DALYs (WHO, 2013).

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[2] While death due to chronic conditions is common, it is important to understand when death results from undiagnosed or poorly managed conditions, described as "premature" by WHO. But the WHO Global Health Observatory measure of premature death is limited to deaths that occur before age 70, and therefore it misses those that could have been delayed among people over age 70. "The upper limit of 70 years was chosen for two reasons: (a) to identify an age range in which these chronic disease deaths can truly be considered premature deaths in almost all regions of the world.... in all regions except the African Region, the average expected age at death for 30 year olds already exceeds 70 years; (b) estimation of cause-specific death rates becomes increasingly uncertain at older ages because of increasing proportions of deaths coded to ill-defined causes, increasing levels of co-morbidity, and increasing rates of age mis-statement in mortality and population data sources" (WHO, 2022b).

The most recent iteration of the Global Burden of Disease study assigned disability weights based on household survey responses in five countries, plus a web survey. Although older adults have the greatest levels of disease and disability, 75 percent of those whose responses were used to determine the disability weights were under age 50, while only 5 percent of respondents were aged 70 and older (Salomon et al., 2012). In the meantime, this report and others must rely on indirect and imperfect quantification through YLDs and DALYs.

The Health of Older People

One myth about older people as a group is that most are in poor health and frail. The reality is that the health of older adults is heterogeneous, although at a population level it declines with age. All of the statistics below have limitations. The presence of a chronic condition, need for assistance with ADLs, and healthy/unhealthy health status does not mean that a person is not thriving. When the environment is supportive of people with disabilities and when the health care system effectively manages chronic conditions, people can still thrive and live lives of meaning and purpose. Moreover, data capture is inconsistent across countries, so reported numbers may not be comparable. Finally, researchers select the population of interest. In aging research, different cutoff ages are selected, as indicated below for the study by Garin and colleagues (2016) on chronic conditions (50 and older), for ADLs in Organisation for Economic Co-operation and Development (OECD) countries (65 and older), and in the publication by Rofman and Apella (2020) (60 and older). Harmonizing these differences is beyond the scope of this report.

One often reported measure of health is whether a person has two or more chronic conditions. One study revealed wide variation in the percentage of people over age 50 with more than one chronic condition: China (45 percent), Ghana (48 percent), India (58 percent), Mexico (64 percent), Russia (72 percent), and South Africa (63 percent) (Garin et al., 2016).[3]

Functional capacity, as measured by the need for long-term care, services, and supports, is also heterogeneous. Thirty percent of people aged 65 and older in OECD countries need assistance with ADLs (OECD, 2020). The following are percentages of people aged 60 and over reporting one or more ADL limitations (Rofman and Apella, 2020):

- Brazil 2013: 15.45 percent
- Mexico 2001: 14.57 percent; 2012: 21.19 percent
- Chile 2013: 13.13 percent
- Costa Rica 2009: 32.5 percent
- China 2011: 12.15 percent
- United States 2002: 26.33 percent; 2012: 22.1 percent

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[3] The conditions included in studies of the prevalence of chronic conditions are not standardized; therefore, studies may not be directly comparable.

The U.S. government estimates that one in three people aged 65 and older will never need long-term care, 20 percent will need it for more than 5 years, and the remainder will need it for less than 5 years (ACL, 2022).

Across countries, regardless of income level, the number of unhealthy years of life[4] is increasing, with people in high-income countries having the most years in poor health (see Figure 6-2).

Health Spending

As discussed below, chronic conditions are the primary cause of illness, disability, and death globally. Therefore, the majority of health spending is for preventing, diagnosing, and providing care for chronic conditions.

Between 2000 and 2019, health spending per capita climbed 134 percent (Murphy and Topel, 2006). During this same period, health spending as a percentage of gross domestic product (GDP) increased globally from 8.63 to 9.845 percent, a 14.08 percent increase (Ohnsorge and Yu, 2021). The United States spends 18 percent of GDP on health.

A 2019 analysis calculated global health care spending to be USD8 trillion in 2016 and predicted it to climb to USD15 trillion in 2050. The authors describe

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[4] Staff calculated unhealthy life expectancy using data from WHO by subtracting healthy life expectancy at age 60 from life expectancy at age 60. Healthy life expectancy is defined "as average number of years that a person can expect to live in '"full health"'" by taking into account years lived in less than full health due to disease and/or injury." The calculation includes YLDs.
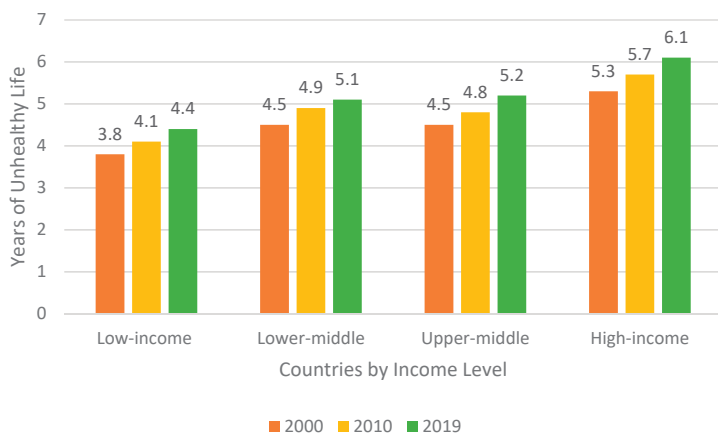

FIGURE 6-2 Years of unhealthy life after age 60.
NOTES: Health measurement has been refined since 2000, and self-reported responses to the same questions have changed over time. Measures of health may therefore have deteriorated subjectively but not objectively.
SOURCE: Staff calculation using World Health Organization data (WHO, 2019).

extreme inequity between high- and low-income countries. The ratio of health care spending in high-income countries to that in low-income countries was 130 to 2 in 2016; the ratio is predicted to remain the same in 2050 (Chang et al., 2019). The limited government spending on health in low-income countries shifts the burden of paying for care to the individual and family; in these countries, 40 percent of health expenditures are out of pocket, limiting access to health care. Globally, per capita out-of-pocket expenditures rose by more than 100 percent between 2000 and 2018 (World Bank, 2021).

One measure of whether a country is tending to the social determinants of health is the relationship between health spending and social spending. Higher social spending is correlated with better health outcomes, while higher health care spending is negatively correlated with health outcomes (Bradley et al., 2016; Dutton et al., 2018). Among OECD countries, the United States is an outlier: its health care spending is far higher than that of other countries, while its social spending is near the middle. If U.S. Social Security retirement payments were excluded from the social spending calculation, the United States would be closer to the bottom of OECD countries in social spending.

Alignment with Other Efforts

As the commissioners conceptualized this chapter, they started from the baseline of the *World Report on Ageing and Health* and the WHO Decade of Healthy Ageing, which is scheduled to last through 2030 (WHO, 2020a). This chapter builds on those efforts to look beyond 2030. This chapter aligns with UN SDG 3, Good Health and Well-being. All of the targets within SDG 3 would promote healthy longevity (UN DESA, 2022).

Finding 6-1: The number of years in poor health has increased globally since 2000 along with life expectancy.

Finding 6-2: Health has gross domestic product value and intangible value. When economists have developed methods to assign numeric value to good health, they have found that people assign enormous value to good health.

Finding 6-3: Higher social spending is associated with better health outcomes; higher health spending is associated with worse health outcomes. U.S. spending, including dramatically higher spending on health care than on social programs, is out of balance compared with that of other Organisation for Economic Co-operation and Development countries.

KEY TARGET: CHRONIC CONDITIONS

Biological Aging and Risk Factors for Chronic Conditions

Chronic conditions are often portrayed as discrete pathologies, but researchers have begun to uncover the biological processes of aging and their relationships to chronic conditions. When aging processes are combined with unfavorable genetics, behaviors, and social and physical environments, and even with infectious diseases,[5] they can increase people's vulnerability to chronic conditions (Kennedy et al., 2014; Sierra, 2016). Aging processes can also lead to declines in capacity unrelated to the presence or absence of disease, such as geriatric syndromes, including delirium, falls, frailty, syncope, and urinary incontinence (Inouye et al., 2007).

The inevitability of chronic conditions and functional decline in older ages has been portrayed as fact. It is becoming increasingly evident, however, that the trajectory of health as people age may improve with a healthy social and physical environment and individual decisions about diet, physical activity, and substance use (Sierra, 2016). As discussed in Chapters 4 and 5, governments, employers, and other actors can influence health outcomes population-wide by reducing adverse social determinants of health—whether social factors, such as ageism, or physical environment factors, such as air pollution.

Four health behaviors (tobacco and unhealthy alcohol consumption, unhealthy diet, and physical inactivity) are major contributors to the development of the four conditions responsible for 80 percent of chronic disease deaths ("cardiovascular disease, cancer, chronic obstructive pulmonary disease, and diabetes") (Hunter and Reddy, 2013, p. 1336). From a different perspective, Halpin and colleagues (2010) describe physical inactivity, unhealthy diet, and obesity as "a lethal combination" of risk factors, increasing the risk of cardiovascular disease, diabetes mellitus, cancers, metabolic syndrome, and osteoarthritis (p. 126). Research suggests that behavior change, such as improved sleep and midlife physical activity, may even reduce the risk of developing a chronic condition for which a person has a genetic predisposition, such as the apolipoprotein e4 gene, which increases the risk of developing Alzheimer's disease (Mendelsohn and Larrick, 2013; Stephen et al., 2017).

The Global Impact of Chronic Conditions

Globally, chronic conditions are the greatest cause of death and YLDs (Lozano et al., 2012). Even in lower-income countries, which tend to have younger populations and a higher infectious disease burden relative to high-income countries, chronic conditions are the leading cause of death and disability. The percentage

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[5] The traditional distinction between communicable or infectious diseases and chronic or noncommunicable conditions has been discredited by research that links infectious diseases, especially viruses, to chronic conditions.

of YLDs attributed to chronic conditions in low-income countries is lower than the global average but still is more than 75 percent (IHME, 2019). It is therefore important to address chronic conditions in countries of all income levels.

Several factors in combination have created this growing global challenge. The increase in the number of people living with and dying from chronic conditions is a side effect of successfully increasing longevity globally in the past 100 years: more older people are living, and older people are more likely to develop chronic conditions (Lozano et al., 2012).

Economic and Fiscal Impacts of Chronic Conditions

Beyond the adverse impacts on people's health as described earlier in this chapter, chronic conditions impose an enormous economic burden on individuals, families, and society, including the rising health care costs discussed above. Bloom and colleagues (2012) used three approaches to estimate the costs of chronic conditions: estimated direct and indirect costs, lost output, and the economic burden of life lost. Box 6-1 defines these approaches and presents the authors' estimates of the cost burden of chronic conditions associated with each. The authors conclude that the impacts and costs are dauntingly large, regardless of approach (Bloom et al., 2012).

BOX 6-1
The Noncommunicable Disease Cost Tally

- "Cost-of-illness approach: estimates of direct and indirect costs of ill health for five distinct disease categories:
  - Cancer: an estimated USD290 billion in 2010, rising to USD458 billion in 2030
  - Cardiovascular disease: an estimated USD863 billion in 2010, rising to USD1.04 trillion in 2030
  - Chronic obstructive pulmonary disease: an estimated USD2.1 trillion in 2010, rising to USD4.8 trillion in 2030
  - Diabetes: an estimated nearly USD500 billion in 2010, rising to at least USD745 billion in 2030
  - Mental Illness: an estimated USD2.5 trillion in 2010, rising to USD6 trillion by 2030"
- WHO EPIC approach: "lost output due to five conditions (cancer, cardiovascular disease, chronic respiratory diseases, diabetes, and mental health) over the period 2011–2030 is estimated at nearly USD47 trillion"
- Value of a statistical life approach: "the economic burden of life lost due to all noncommunicable diseases ranges from USD22.8 trillion in 2010 to USD43.3 trillion in 2030"

SOURCE: Bloom et al., 2012, p. 35.

Finding 6-4: Health is malleable through efforts addressing modifiable factors that accelerate the aging process and contribute to earlier onset of chronic conditions.

Finding 6-5: Chronic conditions are responsible for 80 percent of deaths and years of healthy life lost due to disability globally, including in low-income countries, where the median age is lower than in high-income countries.

Finding 6-6: The costs associated with chronic conditions, including the costs of care, lost output, and the burden of lost life globally, are extremely high. Lost output due to cancer, cardiovascular disease, chronic respiratory diseases, diabetes, and mental health during 2011–2030 is estimated at USD47 trillion, and the burden of lost life annually is estimated to range from USD22.8 trillion in 2010 to USD43.3 trillion in 2030 (Bloom et al., 2012, p. 35).

Conclusion 6-1: The importance of slowing aging and the onset of chronic conditions and thereby prolonging good health supports the need for public health and health care systems that are preventive, proactive, and predictive, and that target shared risk factors for accelerated biological aging and onset of chronic conditions.

KEY TARGET: PUBLIC HEALTH

Public health systems[6] are the single most powerful structure for tackling chronic conditions and equitably improving population health. Public health uses population-wide surveillance and interventions (e.g., policy, community-based programs, messaging about healthy behavior, screening, immunization, contact tracing, and inspection) to promote health across populations. According to DeSalvo and colleagues (2017, p. 3), "Public health is what we do as a society to ensure the conditions in which everyone can be healthy. It minimizes threats to health that can be averted or lessened only through collective actions aimed at the community." Creating healthy longevity will require a "new public health" that works to prevent chronic conditions at the societal, community, and individual levels (Halpin et al., 2010).[7]

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[6] Public health systems have different functions in different countries. In this report, the definition of public health is limited to population-wide efforts and some direct contact with individuals by public health workers (e.g., community screening, vaccination clinics).

[7] WHO essential public health operations to deliver public health services are (1) surveillance, (2) monitoring, (3) health protection, (4) health promotion, (5) disease prevention, (6) governance, (7) public health workforce, (8) funding, (9) communication, and (10) research (WHO, 2022c).

The Health Impact Pyramid Framework

The health impact pyramid depicted in Figure 6-3 can inform investments in prevention by identifying those interventions having the greatest population-wide impact and requiring the least individual effort (at the bottom) and those having the least population-wide impact and requiring the most individual effort (at the top) (CDC, 2022). The bottom two tiers of the pyramid, discussed below, comprise public health interventions targeted to populations. The top three tiers, which comprise efforts to improve population health one person at a time, are addressed in the next section, on the role of person-centered integrated health care in preventing and managing chronic conditions. Although the pyramid was developed in the United States, a 2019 review article emphasizes the need for low- and middle-income countries to shift away from a focus on identifying individual risk factors and screening to a focus on the interventions at the bottom of the pyramid (Miranda et al., 2019).

Socioeconomic Factors

Socioeconomic factors form the base of the health impact pyramid because they are foundational to health and are delivered at the population level (see Chapters 4 and 5). Public health organizations might be expected to use surveillance to identify the social, environmental, and financial threats to health; geographic areas at risk; and subgroups at high risk. But public health agencies, though within larger governmental structures, may have little or no access to or
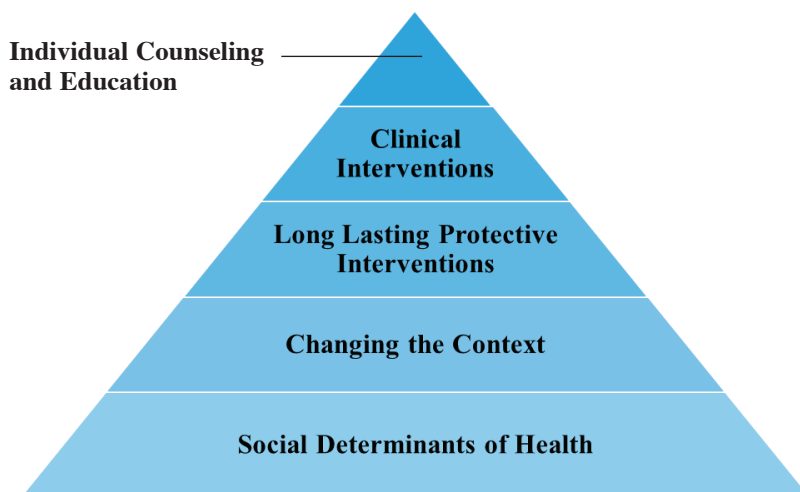
FIGURE 6-3 The health impact pyramid.
SOURCE: Adapted from CDC, 2022.

control over the government entities that address socioeconomic factors. They must therefore collaborate across government ministries, departments, and agencies. This observation is consistent with recommendations made by WHO in the *Conceptual Framework for Action on the Social Determinants of Health,* which states that public health systems will need to be involved in the efforts of other government entities, such as those that provide social services, to help target interventions with significant public health impacts (WHO, 2010a). One U.S.-based research team has recommended using a chief health strategist to connect local public health departments to other stakeholders to address adverse social determinants of health (DeSalvo et al., 2017).

> Finding 6-7: Addressing social and economic risk factors is a necessary part of a public health strategy for preventing chronic conditions. To address social and economic risk factors successfully will require collaboration between public health and other government agencies and private-sector stakeholders that can influence health behaviors, such as unions and employers.

Changing the Context

Interventions at the next level of the health impact pyramid change the context in which health behaviors occur. They can include laws, policies, and regulations; public messaging about how to improve health (e.g., tobacco cessation, quality nutrition, and physical activity); and behavioral economics interventions (e.g., taxes on tobacco products, alcohol, and sugary drinks). The aim of changing the context is to make the default decision the healthy one.

Changing the context requires multipronged strategies. For example, a combination of urban design that creates safe bicycle or walking lanes, employer incentives to walk or bicycle to work, and public messaging about the importance of physical activity could change individuals' default decisions about transportation, leading to improvements in the environment and physical activity levels. Chile, for instance, recently developed a multifaceted approach to promote healthy eating habits through food labeling and advertising policies. The Chilean law mandated front-of-package warning labels for products high in saturated fat, sugar, and sodium while also restricting positive marketing of these products and banning their sale in schools. Although researchers were unable to determine whether the labeling or the advertising policy had a greater effect on sales, they concluded that, in combination, the policies discouraged and reduced consumption (Taillie et al., 2021).

For public health to be inclusive of older people, the context must be relevant to them, which may require different messaging and methods. Educating people about the significant impact of daily health behaviors on cognitive function and giving them information about the impacts of specific behaviors is an example of an intervention that is relevant to older people. Examples of study results that

could influence older people's choices include a study suggesting that people over age 45 with a higher daily intake of fruits and vegetables had better cognitive function (Jiang et al., 2017). Another study suggests that older people who engage in vigorous physical activity at least once a week may be half as likely as those who are inactive to develop cognitive impairment and 30 percent less likely to need assistance with daily living (Jiang et al., 2017). Public health messaging to older people could combine education about the benefits of a healthy diet and physical activity with information about how urban dwellers can access fresh fruits and vegetables, such as a program in New York City, whereby older people can purchase inexpensive bags of fresh produce at easily accessible locations (West Side Rag, 2021).

Across all ages, efforts to change the context through targeted messaging and methods are better at effecting behavior change than approaches that appear to blame the victims of social determinants of health for the behaviors they drive (Crawford, 1977). More recent publications also express concern about the fine line between health education and blame (Brown, 2018).

> Finding 6-8: Multimodal interventions that change the context for health choices, making the default choice the healthy choice, show promise for decreasing the risk of chronic conditions and improving health by changing individual health behaviors.

Investment in and Return on Investment from Public Health Prevention

Despite its importance, public health is chronically underfunded in countries around the world. Even as the threat of increasing numbers of older people with chronic conditions and more years of poor health has grown, public health spending patterns have largely remained unchanged in higher-income countries. Among 32 OECD countries in 2015, none allocated more than 6 percent of total health expenditures to preventive care. In 2018, average spending across these countries was 2.4 percent for "any measure that aims to avoid or reduce the number or the severity of injuries and diseases, their sequelae and complications" (Kamal and Hudman, 2020).

Researchers have been evaluating the return on investment of structural public health interventions, as distinct from individually focused interventions, especially at the time governments were cutting programs following the global financial crisis from 2008 to 2015. A systematic review of 52 studies evaluating the return on investment or cost/benefit ratio of public health interventions in high-income countries found that the return on investment was 14.3 to 1, and the cost/benefit ratio was 8.3. The largest benefits were seen in studies of national public health initiatives, where the median return on investment was 27.2 to 1, and the cost/benefit ratio was 17.5 (Masters et al., 2017). Many of the public health interventions with positive cost-benefit ratios or documented

return on investment included in the review focused on structural changes, including speed cameras and speed zones, water fluoridation, preschool and school age education programs, bicycle and pedestrian trails, road safety campaigns, anti-stigma marketing campaigns, sugar sweetened beverage tax, and lead paint control. Similarly, the WHO Case for Investing in Public Health reports on cost-effective public health interventions including tobacco and alcohol legislation, salt reduction, violence reduction, walking and cycling promotion, green spaces, safe transportation and housing, and healthy employment (WHO, 2014). A U.S.-based evidence review highlighted evidence supporting the cost effectiveness of home meal delivery, meal planning, and improving access to healthy food; transportation to health care appointments; and home modifications for people with functional limitations (Tsega et al., 2019).

The commission anticipates that resource constraints will make rebalancing spending between public health and health care spending necessary in all countries, but especially in low- and middle-income countries with the greatest need for structures in both areas, and the most limited resources. Investing in structures to address social determinants of health, such as the examples shown in Boxes 6-2 and 6-3, has the potential to mitigate rapidly rising health care costs. The first, Box 6-2, describes changes made in Costa Rica in the 1940s that have resulted in a higher life expectancy than in countries with similar income levels.

The second, Box 6-3, describes structural factors that change the context of tobacco use identified in the WHO Framework Convention on Tobacco Control.

Conclusion 6-2: Changing the trajectory of increasing numbers of people with chronic conditions will require a change in how governments balance public health and health care spending. Strategies for making significant changes in spending allocations are most effective when they are multimodal, in contrast to attempts to achieve significant change through a one-dimensional intervention, such as changing methods for provider reimbursement.

Public Health Data and Analysis for Prevention of Chronic Conditions

Public health entities rely on epidemiological data and analysis to conduct surveillance on public health threats and improvement monitoring. Beyond traditional analytic methods, public health is increasingly benefiting from enhanced computational capabilities and data availability, as the COVID-19 pandemic has demonstrated. Globally, however, and especially in low-income countries, data are inadequate for effective surveillance, especially at the subpopulation level. The absence of these data makes it difficult to monitor progress toward health-related SDGs or toward healthy longevity at the national and subnational levels.

BOX 6-2
Costa Rica and Social Determinants of Health

In the 1940s, the government of Costa Rica invested in clean water, educa-tion, health care, and well-being. The focus on overall welfare, rather than simply health care, improved multiple aspects of life that influence health. For example, its educational system lifted people out of poverty and gave them access to better sanitary conditions. In addition to the universal health system described in Box 6-6, there is joint responsibility for health shared among private and public domains, and between workers and employers. The government also analyzes economic decisions from the perspective of their impacts on health. The result is that Costa Rica, which is ranked by the United Nations Development Programme as "High" development driven in part by national income, has results consistent with countries ranked as "Very High" in life expectancy, mortality rate of children under age 5, and expected years of schooling.

SOURCE: Barr and Michael, 2020.

BOX 6-3
WHO Framework Convention on Tobacco Control

The WHO Framework Convention on Tobacco Control was a response to the global tobacco epidemic. It was the first global public health treaty. Its objective "is to protect present and future generations from the devastating health, environ-mental and economic consequences of tobacco consumption and exposure to tobacco smoke" (WHO, 2003, p. 5). Parties to the convention are required to

- establish essential infrastructure for tobacco control;
- develop and implement comprehensive multisectoral tobacco control strategies, plans, and legislation; and
- protect the process from commercial and other vested interests of the tobacco industry.

Measures to reduce demand include the following:

- Price and tax measures
- Non-price measures to reduce demand
- Protection from tobacco smoke
- Regulation of contents and emissions
- Prevention of misleading packaging and labeling
- Ban on advertising, promotion, and sponsorship

SOURCE: WHO, 2003.

According to WHO, 68 percent of countries have good capacity for surveillance of public health threats, 40 percent of deaths are unregistered globally, fewer than 50 percent of countries are able to monitor care quality systematically, and 60 percent have good capacity to track the progress and performance of the health sector and use data in policy and planning (WHO, 2020b).

Disaggregated data will be particularly important in understanding the risks of subpopulations and targeting interventions to address those risks, as demonstrated by one study that used modeling to evaluate the effects of different strategies for primary prevention of cardiovascular disease. The study found that a public health approach focusing primary prevention efforts for cardiovascular disease on subpopulations with significant risk factors would be more cost-effective and save more lives than broad population-wide screening (Kypridemos et al., 2016). Capturing health data disaggregated by gender and age bands (e.g., exact age or decade age bands, not 0–14, 15–64, and 65+) will be necessary at the national and community levels to understand the most important contributors to health and healthy longevity. Capturing data on social determinants of health globally is critically important and more difficult relative to data on age and gender, requiring data collection methods not currently in use. The COVID-19 pandemic has illustrated the need for data that allow stratification, because stratified analysis of outcomes has highlighted disparities in outcomes across age, socioeconomic status, and race.

While current data collection efforts rely on methods that are costly and time-consuming, new technologies have the potential to collect relevant public health data using passive collection approaches. One study, for example, suggests the feasibility of using deidentified mobile phone data to understand the spread of cholera in Haiti and track the movement of people during an infectious disease outbreak (Bengtsson et al., 2015). Billions of people globally have smartphones or wearable devices with tracking capabilities, and with proper privacy protection, these data could be used, for example, to evaluate physical activity and walking speed down to the neighborhood level.

With new forms of data capture and analytics, precision public health is being proposed as an approach to "provid[e] the right intervention to the right population at the right time" (Khoury et al., 2016, p. 398). This approach will be important to achieving the vision for health laid out at the beginning of this chapter. Precision public health takes advantage of new techniques for surveillance of diseases, exposures to toxins or communicable diseases, health behaviors, and overall population health. Proponents emphasize that in contrast to precision medicine, which may be available only to people with higher incomes, precision public health is designed to use data to target services and interventions to those with the greatest need (Horton, 2018). Future use of this approach is, however, contingent on privacy protection and transparency of models, as discussed later in this chapter.

The current capabilities of precision public health and advanced analytics are still limited: classic statistical methods perform as well as artificial intelligence

(AI) models in identifying disparities (Khoury et al., 2020). AI is not yet in widespread use, so it remains unproven. But the commission predicts that significant change in data capture and analysis methods will take place in the coming decades, with AI becoming a powerful tool for segmenting populations and delivering targeted public health interventions where they will have the most impact.

Levers for Change

Public health organizations face two barriers to shifting the emphasis toward aging and chronic conditions. First, they have limited ability to influence other government agencies with authority for addressing social determinants of health, including availability of social services, clean air and water, safe housing, and walkable communities, among others. Public health also needs to be involved in decisions about health care and long-term care, and the three systems need to work in concert on prevention efforts, coordinating across the full health impact pyramid—something that is not yet a reality in most places. Public health messaging, about controlling hypertension, for example, lacks value if a person with hypertension cannot get quality, affordable care to manage the condition. Public health will need a seat at the table to ensure that there is a concerted effort across governments to respond to epidemiological evidence about what works and where resources are needed. Second, public health departments around the globe lack resources. If countries continue to allocate a third or more of their health expenditures to in-patient care, at least some of which is avoidable, public health will remain underfunded, and people, especially older people, will face avoidable illness, functional impairment, and early death. To make these changes, political will and reallocation of resources will be needed, but given the diversity of interests globally, the commission's roadmap cannot make recommendations on how to achieve the changes.

Public health, in conjunction with biomedical research, has had tremendous successes during the COVID-19 pandemic. Notably, vaccine development and distribution was more effective and expeditious than most "moonshot" efforts, such as cancer moonshots in the United States and Europe. Harnessing that success could potentially overcome the historical inability to shift resources from health care to prevention.

Metrics

The UN SDGs related to public health (aside from specific disease focus) include the following:

- 3.4.1: Mortality from cardiovascular disease, cancer, diabetes or chronic respiratory disease, including adults aged ≥70 years
- 3.4.2: Mortality rate from suicide, by age and sex across the life course

- 3.a.1: Age-standardized prevalence of current tobacco use among persons aged 15 years and older
- 3.b.1: Proportion of the target population covered by all vaccines included in their national program

The metrics for the WHO Best Buys for public health interventions include

- tobacco use,
- physical activity,
- harmful substance use, and
- healthy diet.

(Note that the disease management best buys are included in the health care delivery section.)

Data Needs and Research Questions

The commission emphasized the need for more granular data about health than are currently available. Specifically, longitudinal data collection on health status, including physical and cognitive functioning, stratified in narrow (e.g., 10-year) age bands and by sex, will be necessary to understand the impacts of public health interventions and progress toward healthy longevity. The commission also emphasized the need to collect data on social determinants of health at the individual level. One potential source of such data is the United Nations' Titchfield Group on Ageing-related statistics and Age-disaggregated Data (UN Statistics Division, 2021).

An important emphasis for research methods is the need to include older people in research design, not just as research subjects—for example, as coinvestigators.

One structural question about public health is how to shift health systems away from reactive, disease-focused health care toward preventive and proactive models. Despite widespread agreement on public health targets and the need to reallocate funding, this shift has not occurred. Answering this question will require cross-disciplinary expertise in systems change theory and complex systems dynamics, policy, and public health.

Another research question is how to effect behavior change across populations. This section has described how to change the context, but even with a context that supports healthy behaviors, many people still make unhealthy choices. The success of public health interventions is dependent on successful behavior change strategies at the individual level.

Recommendation 6-1: To achieve the goal of the best possible health for older people, governments, over the next 5 years, should develop strategies to increase investments in robust public health systems that build

and lead collective actions for promoting health at the population level and across the life course.

   a. **Investments in public health systems may require governments to rebalance investments in health care and public health.**
   b. **Public policies should create incentives for individuals, employers, and communities to engage in prevention and wellness activities.**
   c. **All countries should establish 5-year targets for preventive health and measure progress toward those targets.**

KEY TARGET: HEALTH CARE DELIVERY

The health care delivery system has multiple roles to play in promoting healthy longevity and reducing the burden of chronic conditions and their impacts at the individual and societal levels. Prevention roles for the health system include individual-level screening, preventive measures (e.g., vaccinations), long-lasting interventions (the third level of the health impact pyramid), clinical interventions (the fourth level), and education and counseling (the fifth level). Along with prevention, the most important roles of a health care system in caring for people of all ages are to identify, diagnose, and treat those at highest risk of developing disease (e.g., managing hypertension as a risk factor for cardiovascular disease).

If a disease progresses, the health care system should optimally manage the condition to avoid the onset of new complications, avoid acute exacerbations, minimize symptom burden, and slow the loss of function, in addition to addressing any acute care needs that arise. Even though the health impact pyramid is focused on prevention, its levels apply to the management of chronic conditions and long-term care across all stages of health. Every aspect of care should include a focus on the person's social needs, whether access to clean water or refrigeration for medications, the ability to pay for medications, or avoidance of unsafe conditions in the home. Addressing social needs will contribute to preventing or slowing disease progression and providing the structures needed to maximize functional capacity in the face of decline (e.g., through the use of a supportive physical environment). Similarly, contextual factors that support prevention (e.g., enabling access to fresh fruits and vegetables) contribute to management of advancing chronic conditions.

The commission recognizes the importance of accessible and affordable quality health care as a critical component of healthy longevity. This section focuses on the delivery of integrated person-centered care, including geriatric care and primary care, that supports the health of older people. If actualized, this care would be of higher quality than that provided by current systems. The issue of accessible and affordable health care is left to other reports and publications, such as the *World Report on Ageing and Health* (WHO, 2015b) and the UN SDGs, and is not addressed further here.

Current health care systems that were designed to meet acute care needs in the mid-20th century do a poor job of preventing and managing chronic conditions, especially multiple chronic conditions and geriatric syndromes. Within most systems around the globe, health care systems and providers are paid for procedures and visits, not for health outcomes. Specialty care further entrenches a disease-centered, not person-centered, approach to care. Primary care in much of the world is underfunded, and providers are burdened with many obligations, which can make it difficult or even impossible to provide care for the whole person. These challenges affect people of all ages.

More than a decade ago, an editorial in the *Journal of the American Geriatrics Society* described the poor-quality and ineffective care of older people as "an emblem of what is wrong with health care" (Reuben, 2009, p. 2348). It described older people receiving "a lot of health care, some appropriate and some inappropriate, with little coordination or consideration of the big picture" (Reuben, 2009, p. 2348). There is consensus that treatment focused on individual conditions too often is either ineffective or harmful to older people, and that their care should be driven by their goals, values, and preferences. Experts in the care of older people advocate abandoning disease-focused care because "medical care that is centered on the diagnosis and treatment of individual diseases is at best out of date and at worst harmful [because a] primary focus on disease may inadvertently lead to under treatment, over treatment, or mistreatment" (Tinetti and Fried, 2004, p. 179). By following clinical guidelines for discrete medical conditions without taking the whole person and multiple conditions and context into account, providers can harm people with multiple chronic conditions, who represent the majority of older people.

Illustrations of how poorly current systems address the needs of older people are found in Boxes 6-4 and 6-5. The first, presented in Box 6-4, shows the decline following a stroke in a previously active 91-year-old woman and the challenges her family encountered in providing appropriate care, even though her son was a physician.

The second case study describes a woman who was unable to access timely and necessary care after sudden onset of symptoms of unknown origin that were ultimately diagnosed as a recurrence of cancer.

Primary Care

Primary care has a central role in the delivery of care within an integrated, person-centered health care system. A recent National Academies report defines high-quality primary care as "the provision of whole-person, integrated, accessible, and equitable health care by interprofessional teams that are accountable for addressing the majority of an individual's health and wellness needs across settings and through sustained relationships with patients, families, and communities" (NASEM, 2021, p. 45). Primary care has also been shown to be the most

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BOX 6-4
An Older Person's Experience of Care: The Current State

Mrs. X is a 91-year-old woman who lived an extremely active and fulfilling life, participating in hobbies including hiking, cross-country skiing, tennis, cooking, and entertaining until her late 80s. In January 2021, at the age of 90, she suffered a stroke resulting in profound weakness of her left arm and leg, with associated spasticity. Overnight, this previously physically robust older adult had to contend with a drastic decline in functional status to the extent that she had become dependent on family and personal care aides for nearly all basic and instrumental activities of daily living, including transfers. The patient's son, a retired physician well versed in the health care system, still experienced numerous frustrations with a health care system that was misaligned with his mother's care needs.

Well-intentioned primary care physicians and specialists rarely communicated with each other directly about Mrs. X, and this communication almost never occurred if they were in separate health care systems. These physicians were trained to focus on solving individual medical problems but seldom asked Mrs. X the most important question for patients with chronic illness: What matters most to her? Mrs. X wanted to enjoy time with her family and improve her ability to transfer and use her arthritic hand. Since her stroke, physicians who ordered studies such as outpatient labs and X-rays rarely, if ever, considered her mobility or comfort in weighing the value of tests that required transferring in and out of a vehicle to travel to and from the clinic and positioning for labs and X-rays.

Mrs. X was given medications that she did not previously require, with the attendant risks of drug–drug interactions and side effects and risk/benefit trade-offs. Should the gabapentin be increased to address neuropathic pain at the expense of increased leg edema, increased somnolence, and decreased quality of interactions with her family? There was often little time to discuss trade-offs with health care providers, who were already overwhelmed by the prospect of addressing multiple chronic conditions in a single visit.

When Mrs. X developed an abrupt change in cognition consistent with delirium, the care team considered whether the change was due to medical problems, such as a urinary tract infection or pneumonia, or to a medication side effect. Because of her significant mobility limitations, she could not be positioned properly for an X-ray, nor could a urine sample be obtained in the outpatient clinic. A conversation about what mattered most ensued: Did the need to diagnose and treat her illness in the emergency department, with the attendant hazards of hospitalization if she were to be admitted, outweigh her desire to go home? This time, the question was discussed with the patient, who valued being with her family above all. A plan was made for her family to monitor her vital signs frequently overnight in lieu of an emergency department visit. The next day, after a night with adequate rest, Mrs. X sought care in the emergency department and was admitted for an overnight stay to receive a brief course of antibiotics. This approach may have prevented a much longer hospital stay by avoiding exacerbation of her delirium, which could have occurred with an overnight hospital admission.

SOURCE: Personal communication with Timothy W. Farrell, MD, American Geriatrics Society Fellow, February 7, 2022.

BOX 6-5
Case Study: Disintegrated Care for Cancer

A retired physician was aware that a friend, Mrs. A, was being followed by an oncologist because she had a history of colon cancer. She had been cancer-free for 15 years, was in her 70s, and had been married for 50 years. She had obesity and chronic kidney disease, but had no difficulty walking or getting up and down stairs. Mrs. A told her friend that her tumor markers were increasing exponentially. A few weeks after this dramatic increase, the oncologist ordered a computed tomography scan, which revealed a tumor the size of a walnut. The oncologist scheduled a biopsy 2 weeks later, with results due 2 weeks after that. The biopsy was positive for colon cancer. The oncologist ordered genetic testing, with results due 3 weeks later.

During this time, Mrs. A asked her friend whether she and her husband could build a ramp over the two steps leading out of her house, explaining that over 2 days, her legs had become so swollen that she could no longer walk down the two stairs. The friend visited Mrs. A and found that she had 3–4+ pitting edema. At her friend's urging, Mrs. A called the oncologist, and was told she had to schedule an appointment with her primary care physician because the oncologist did not manage edema. The primary care physician said she could not have an appointment until 2 weeks later but ordered a diuretic, despite Mrs. A's high blood calcium levels and chronic kidney disease. Subsequently, the primary care physician called and said Mrs. A could come in 1 week sooner than her scheduled appointment, but Mrs. A was too ill to leave the house. Her friend suggested she ask for home health care, but the primary care physician would not order it because he had not seen Mrs. A for the edema.

Three weeks after the onset of the edema, the oncologist ordered home-based palliative care for Mrs. A, but the palliative care provider refused to do anything about the edema because Mrs. A was scheduled to see the oncologist the next day. The next day, the oncologist's office called to postpone her appointment, but Mr. A stated that Mrs. A had to be seen right away. Around this time, the friend palpated Mrs. A's abdomen and felt a tumor the size of a muskmelon.

The next day, the oncologist told Mrs. A that she had colon cancer and based on the genetic studies, there was no option for chemotherapy, recommending that she continue with home-based palliative care. Mrs. A went for the scheduled visit with her primary care physician, who told her he could not provide any care because she had cancer and he was not going to treat it. Mrs. A called the oncologist, who referred her to hospice.

SOURCE: Personal communication with Jane MacPherson, MD, February 7, 2022.

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efficient mechanism for delivering high-quality, cost-effective care around the world (WHO, 2021). High-quality primary care is critical for health, and requires functional partnerships across systems to maximize the capacity of individuals by addressing social determinants of health (Kruk et al., 2010). Box 6-6 highlights Costa Rica's successful primary care system.

BOX 6-6
Costa Rica's Primary Care System

In 1995, Costa Rica launched a new public health and primary care system that merged public health and hospital systems, integrated medical record systems across the country, and allowed health officials to set proper objectives for the health care system. Before Costa Rica reformed its health care system, only 25 percent of the population had proper access to primary care, and mortality due to communicable diseases affected more than 65 of every 100,000 people. By 2006, 95 percent of the population had access to care, and mortality from communicable diseases had declined to 4.2 per 100,000 people.

Factors contributing to the program's success include an initiative to assign all insured Costa Rican residents to a local primary health care team that includes a physician, a nurse, and a trained community health worker. The local primary health care teams were first assigned to rural communities, which were most likely to experience health care inequities, an approach that led to a rapid increase in coverage. Additionally, community health workers play a vital role in developing relationships with their patients, allowing for early diagnosis of diseases and conditions while promoting nutrition, physical activity, family planning services, and more. Widespread yearly wellness visits aid in the prevention of medical conditions and allow those with chronic conditions to have a guaranteed visit with health care providers.

Despite this success, the growing aging population is likely to increase geriatric health care needs that are not necessarily covered by local health care teams. The result will be to alter the cost of care and wait times for screening and assessments.

SOURCE: Cuccia et al., 2019.

Primary care is ideal for providing preventive care at the individual level across the life course, complementing public health measures at the population level. It includes screening, personal counseling about risk factors, and medication management as conditions that are precursors to more serious age-related conditions are detected. Primary care physicians with training in geriatrics understand the nuances of working with older people to determine what screening is appropriate for them given their goals and health status. But like public health, primary care is often underfunded. A 2012 report from Spain, where primary care makes up 70 percent of all health care, states that only 16 percent of health care funding was dedicated to primary care (Rada, 2012).

Primary care is beneficial in countries across all income levels. A scoping review found evidence that financing, policies, workforce, and core functions are important to primary care systems, but evidence is lacking for implementation strategies to create sustainable systems across different contexts. The research team also found less evidence for the value of population health management, fa-

cility management, safety, and improving quality of service delivery. In low- and lower-middle-income countries, integration of health care will require changes in health policy, health systems, and financing. Countries need to move away from siloed infectious disease and maternal and child care models toward integration and collaboration. To create integrated systems, countries will need to "adopt a diagonal approach that invests in system improvements across the board and demands measurable improvement in health outcomes for multiple conditions" (Kruk et al., 2015, p. 432).

Geriatric Care

As described above, current health systems do not provide the care older people need, especially as chronic conditions become more advanced and functioning declines. Geriatric care is a medical specialty, and many allied health professionals can receive certification in geriatrics. Geriatric care can be delivered as primary care, akin to pediatrics, or as a specialty consulting service. The commission emphasizes the importance of ensuring that all primary and specialty care providers who care for older people have training in geriatrics.

Geriatric care is provided to older people with a focus on the prevention, diagnosis, management, and rehabilitation of chronic conditions, including multimorbidity, geriatric syndromes, and functional decline. Geriatric medical competencies include knowledge of the physiology and biology of aging and causes of aging-related health outcomes, effective management of multimorbidity, and prevention and treatment of geriatric conditions. Box 6-7 describes the key characteristics of geriatric care. Geriatric care is inherently a well-established form of the integrated, person-centered care described below.

The term "geriatrician" typically refers to physicians, most often in internal medicine, or in some countries in family medicine, who have advanced training and board certification in geriatric medicine. The composition and duration of the training and the process for certification vary across countries. Geriatric care teams are interdisciplinary when possible, and may include providers in the disciplines of nursing, pharmacy, nutrition, and physical and occupational therapy. Health care providers in these disciplines can receive additional training and, in some cases, certification in geriatrics.

No specific chronological age qualifies a person for geriatric care, but the older people who benefit most are those with complex care needs, such as multimorbidity, and functional decline. Because most older people with complex care needs prioritize goals that require a threshold level of physical and cognitive function, geriatric care typically prioritizes improvement in or maintenance of cognitive and physical function over medical goals. That said, because decisions about care goals among older patients with chronic conditions are complicated by a lack of clinical guidelines and the challenge of polypharmacy, some geriatricians are encouraging goal-based care, which includes using the person's

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BOX 6-7
Key Characteristics of Geriatric Care

- A special focus on preservation and optimization of functional capacity
- A life-course perspective that recognizes the accrual of advantage and disadvantage over time based on lifestyle, exposures, and other factors
- Management of patients with multiple morbidities, geriatric syndromes, and complex clinical presentations
- Patient-centered care, including comprehensive multidimensional assessment of functional, medical, and social factors
- Clinical operations that usually involve an interdisciplinary team and ensure comfort and dignity in care delivery
- Emphasis on the clinical implications of the biology and physiology of aging
- Care that spans the spectrum from population-based education and prevention to the management of acute illness and long-term care for chronic conditions
- Provision of care in a variety of settings, ranging from the community to acute and long-term care facilities

SOURCE: Provided by the International Association of Gerontology and Geriatrics for inclusion in this report.

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goals to guide care and in some cases to measure the quality of care the person receives.

Multiple geriatric care models have emerged in the United States in recent years, some of which have been exported to other countries. A review article written in 2009 for the Institute of Medicine (IOM) report *Retooling for an Aging America: Building the Health Care Workforce* describes 15 models of care for older people with chronic conditions, all found to be beneficial as measured by one or more outcomes (Boult et al., 2009). The different models had diverse targets, such as disease self-management, comprehensive geriatric assessment and management, pharmaceutical care, and caregiver support. And a 2019 study by 18 multidisciplinary experts from seven countries reviewed eight sets of guidelines for care of people with multimorbidity and polypharmacy alone, which include 250 discrete recommendations across multiple settings and aspects of clinical management and self-management (Muth et al., 2019). The authors highlight the need for further research on clinical guidelines and care models and recommend research questions that are included at the end of this chapter.

The Integrated Care for Older People (ICOPE) model developed by WHO stands out from many other models because it is evidence based, it is more comprehensive than other models, it has a primary focus on assessing and addressing functional outcomes, it embodies a model of integrated care, and it is focused on community dissemination. It is also being tested globally. The ICOPE model

includes guidance for community-level interventions that can be implemented by community health care workers, and provides implementation support to users through a handbook. It also includes an implementation framework for policy makers and program measures to support implementation (WHO, 2022a). The model's domains of focus are "cognitive decline, mobility, malnutrition, visual impairment, hearing loss, depressive symptoms, social care and support," and support for caregivers (WHO, 2022a). The ICOPE approach is highly aligned with multiple areas of emphasis in this chapter.

A detailed analysis of geriatric care models or guidelines is beyond the scope of this report, but a number of barriers have prevented large-scale implementation of these models. The proliferation of competing models is also a challenge, as evidenced by the sheer number of models and recommendations. The primary challenge to implementing the model is the current single-disease approach that dominates health care systems and financing globally. A third challenge is limited evidence of efficacy for discrete elements within the models or of models' efficacy outside narrow settings. Research recommendations related to these barriers are addressed at the end of this chapter.

Integrated, Person-Centered Care

WHO developed a "global strategy on people-centered and integrated health services" to "encourage a fundamental paradigm shift in the way health services are funded, managed and delivered so all people have access to health services that respond to their preferences, are coordinated around their needs, and are safe, effective, timely, efficient and of an acceptable quality" (WHO, 2015b, p. 34). This care approach is important for people of all ages, but especially for people at any age with advanced illness, conditions requiring complex management, or multiple chronic conditions. For these people, clinical guidelines become less helpful in guiding care because treatment efficacy declines and side effect burdens increase, and treatment for one disease may undermine that for another. At this stage, the person's preferences, goals, and values become the yardstick by which clinicians can measure the appropriateness of potential interventions.

According to WHO, integrated, person-centered care (including behavioral health care) is the most effective and appropriate care delivery model for maximizing health, function, and well-being across the life course (WHO, 2015b). It provides a structure and organizing principles for coordinating care across primary, specialty, acute, and long-term care settings. Integrated care "ensures people receive a continuum of services including health promotion, disease prevention, diagnosis, treatment, disease-management, rehabilitation, and palliative care at different levels and sites within the health system, and that care is provided according to their needs throughout their life course" (WHO, 2015b, p. 228). Aspects of care that are positively impacted by integrated care include pa-

tient satisfaction, perceived quality of care, and access to services, but evidence on how integrated care impacts quality of life is mixed (Flanagan et al., 2017).

Person-centered care "consciously adopts the perspectives of individuals, families and communities, and sees them as participants [and] beneficiaries of health care and long-term-care systems that respond to their needs and preferences in humane and holistic ways" (WHO, 2015b, p. 230). In contrast to current disease-focused care delivery, person-centered care is relationship-based; views disease and body systems as interrelated; and is designed around a person's experiences, preferences, and goals (WHO, 2015b, p. 34).

Components Needed for Integrated, Person-Centered Care

WHO's *Global Strategy on People-Centred and Integrated Health Services* builds on its earlier strategies to promote universal health care, primary health care, action on chronic conditions, action on social determinants of health, and enhanced health security through resilient health systems (WHO, 2015a). WHO emphasizes the importance of countries' contexts in moving toward integrated, person-centered care, given that no country has fully achieved the goals of these earlier strategies, although some are further ahead in doing so than others. For example, universal health care is not a reality in some countries across all income levels. Instead of viewing integrated, person-centered care as a new model, WHO suggests that it be viewed as "a service design principle that can help to support and improve strategies that seek to enhance access, encourage universal health coverage, and encourage primary and community-based care" (WHO, 2015b, p. 19). A U.S.-based effort with the goal of promoting integrated, person-centered care in geriatric populations identified barriers that include physician-driven decision making, misaligned incentives, lack of appropriate performance measures, uncoordinated payment structures, and lack of continuity in health records (American Geriatrics Society Expert Panel on Person-Centered Care, 2016).

Integrated person-centered care is relevant across the life course. Even a healthy young adult without complex coordination or care needs can be faced with challenging health care choices influenced by cultural background, religious beliefs, or personal preferences. Moreover, people's journeys through health care systems are established when they are young. Establishing expectations for and the experience of integrated, person-centered care before people face aging can help them reach later life with this approach embedded.

Care coordination, a key component of integrated care, need not be provided by clinicians. An example of a nonmedical approach to coordination is programs in African countries that use "patient guardians" for care continuity during and after hospitalization. The patient guardian is typically a family member who is educated about the role and the person's needs and then continues to support the person after hospital discharge (Basu et al., 2014).

Levers for Change

Care for older people and all people with complex health needs is inadequate in much of the world. Models for integrated, person-centered care abound, but there has been limited success in their widespread adoption. A shift to this type of care would require a tremendous cultural change away from the traditional practice of medicine.

Metrics

Beyond metrics for universal health coverage, including financial risk protection and chronic condition screening and management (e.g., fasting blood glucose, obesity, and hypertension), metrics for evaluating integration and person-centeredness would typically require patient surveys, which are expensive to administer. Metrics using patient-reported outcomes are becoming increasingly feasible with technological advances, but they are still in their infancy.

Health care delivery metrics are extraordinarily complex. Process metrics are the opposite of person-centered in that they assume that every person meeting certain criteria should receive the same intervention, which becomes less true as people age. Second, they can distort incentives. For example, when outcomes related to one condition are measured but those related to another condition are not, funding for the other condition may be diverted to the measured one (Luyckx et al., 2021).

The International Consortium for Health Outcomes Measurement's Older Person Working Group developed a set of outcome measures for older people designed for use in value-based care models. The measures include survival, place of death, frailty, "polypharmacy, falls, participation in decision making and time spent in hospital," and "pain, mood and emotional health, autonomy and control and carer burden" (Akpan et al., 2018, p. 4).

Research Questions

Research is needed to investigate the following questions:

- effective interventions for real-world older people—not just clinical trials that include real-world conditions, such as cognitive function;
- how to promote self-management among people with multimorbidity and barriers to self-management;
- development and testing of value-based care outcome measures;
- effective priority setting between clinician and patient;
- development of consensus for evaluating the quality and efficacy of geriatric care models;

- delivery models for supports related to the social determinants of health in the context of health, such as co-locating services;
- models for sharing social services data with health care providers; and
- efficacy of models for financing integrated health care and social services.

Finding 6-9: Current health care systems do not effectively serve the needs of older people. Integrated, person-centered models informed by principles of geriatric medicine and the biology of older adults can provide coordinated and effective care.

Finding 6-10: Geriatric and geriatric-informed care ensures that care for older people is based on knowledge about their care needs and biology. Effective geriatric care is person-centered and integrated.

Conclusion 6-3: Integrated, person-centered care is the most effective and appropriate care delivery model for maximizing health, function, and well-being across the life span.

Recommendation 6-2: Health care systems should shift to enabling healthy longevity. To catalyze such a shift, actions to be taken by 2027 include
a. **Health systems, in concert with communities and the people they serve, should adopt affordable, accessible, culturally appropriate models, including geriatric care models, for providing person-centered, integrated care for older people facing functional limitations, multimorbidity, frailty, and complex care needs.**
b. **Governments should develop plans to align health care payment and reimbursement systems with healthy longevity outcomes.**
c. **Health care and long-term care systems should begin to develop the infrastructure needed to create integrated continua of care supported by interoperable data systems.**
d. **Health care systems should measure care outcomes based on patient goals and preferences and patient-reported outcomes.**
e. **Relevant licensing and certification bodies should ensure that all health care providers receive training on how the physiology and psychology of aging affect diagnosis and treatment of older patients.**
f. **Governments, professional societies, and health systems should provide incentives to develop and/or maintain a geriatrics workforce, including allied health workers, to focus on older adults with multimorbidity, geriatric syndromes, and declining physical and cognitive functioning.**

g. **Governments, employers, health systems, and communities should empower citizens with the tools and data needed to manage their own health.**

KEY TARGET: LONG-TERM CARE

Long-term care is crucial to enable people with significant loss of capacity to experience lives of meaning and dignity. Even if the health span increases and healthy longevity is achieved at higher rates than today, some people will still need long-term care. Echoing the previous section's emphasis on the importance of person-centered care, it is critical for long-term care to be driven by a person's goals, including where the person wants to live, how care is delivered, and how life is lived. The goals of long-term care are to maximize function, support living with dignity and respect, optimize autonomy, ensure a life of meaning, and provide appropriate health care consistent with the person's goals.

Community-Based, Long-Term Care

Family Caregiving

Globally, the most common site of long-term care is the person's or a family member's home, and the caregivers most often are family members. In the United States alone, AARP estimated that in 2017, 41 million family caregivers provided 34 billion hours of care to an adult, with an estimated value of USD470 billion (Reinhard et al., 2019). Little is known about the adequacy of care provided by family caregivers except that many have little knowledge of how to care for an older person with functional limitations, at least at the beginning of the caregiving relationship. People who receive care typically express gratitude for their caregivers, but abuse by family caregivers is also a concern globally. WHO reports that one in six people aged 60 and older were subject to caregiver abuse in 2017 (WHO, 2021). Such abuse is often associated with caregiver burden and stress (NASEM, 2016). As mentioned in Chapter 4, family caregiving is under strain from demographic changes, including smaller family sizes, women entering the workforce, and migration of younger people from rural to urban areas. Box 6-8 provides an example of quality concerns about family caregivers for people with dementia.

Using caregiving for people with dementia as an example, across 11 sites in Latin America, China, and India, more than half—and as many as 68 percent—of people with dementia live with adult children, except in the Dominican Republic (48.5 percent) and urban China (38.3 percent). Children or children-in-law are typically the main caregivers within the household across all 11 sites (41.6 percent in the Dominican Republic to 79.1 percent in Mexico), with spouses the next most common caregivers. In every location except for rural China, more than 66 percent of family caregivers in the household are female (WHO, 2012).

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BOX 6-8
Quality Concerns About Family Caregivers
for People with Dementia

"When provided, family care may well not meet acceptable standards. Unpaid family caregivers, who are almost always women, often lack basic knowledge about how to care for a frail older person. Furthermore, they are exposed to high levels of stress. A survey of family caregivers for people with dementia in Colombia finds that 55 percent had been providing care for more than three years and few knew much about dementia. The risks of that situation range from unintentionally inappropriate practice to neglect and even elder abuse. A survey of older people in Mexico with long-term disabilities, but not significant cognitive impairment, living at home finds that 32 percent reported having experienced some form of abuse during the previous year."

SOURCE: Rofman and Apella, 2020, pp. 104–105.

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Caregiving experts agree that family caregivers need training to provide adequate care for older people; support for the emotional strain caregiving can bring; and, when possible, financial support, particularly for those who must forego paid work to provide care for a family member (NASEM, 2016). Caregivers have complex roles that may include personal care, help with daily tasks, medication administration, management of medical devices, scheduling of medical appointments, and medical decision making. They may also have physically demanding tasks, such as lifting or bathing a person. Care of people with dementia can be particularly challenging because their behaviors can be confusing or emotionally challenging, and demands such as repeatedly answering the same question can be frustrating. Strategies and programs are available to help caregivers minimize troubling behaviors and cope, but they are not always intuitive, so training is important.

Paid Home Care

Professional home care is less common than family caregiving, but the need is growing with the demographic changes described throughout this report. As with family caregiving, data on training for or quality of paid home care are sparse. Paid caregivers are not always subject to oversight and regulation. In a qualitative study of paid caregivers in the United States, most described the job as imposing intense mental demands due to uncertainty about staffing and the need to live paycheck to paycheck, factors exacerbated by the COVID-19 pandemic (Musumeci et al., 2021). For older people with resources, insurance, or government support, however, paid home care makes it possible to remain in their home, where most people say they want to live.

Nursing Homes

The International Association of Gerontology and Geriatrics (IAGG) and the American Medical Directors Association developed the following definition of a nursing home, sometimes called a care home, based on a survey involving many countries:

> A nursing home provides 24-hour functional support and care for persons who require assistance with ADLs and who often have complex health needs and increased vulnerability. Residency within a nursing home may be relatively brief for respite purposes or short term (rehabilitative), or long term, and may also provide palliative/hospice and end-of-life care. In general, most nursing homes also provide some degree of support from health professionals, but a small subset provide socialization activities and basic assistance with ADLs but have no trained health professionals on staff. Although post-acute rehabilitation may be provided in the nursing home (i.e., in the United States and The Netherlands), in many countries this is provided in separate facilities (i.e., geriatric or cottage hospitals) or in a geriatric unit of the acute hospital. (Sanford et al., 2015, pp. 183–184)

Countries vary substantially in the percentage of older people living in nursing homes. In the United States, for example, 1.5 million people, or 0.05 percent of the population and 4 percent of older adults, live in nursing homes. In Asia, rates range from 0.01 percent of older adults in Indonesia to 5.9 percent in Japan (Hayashi, 2019) (see Figure 6-4).
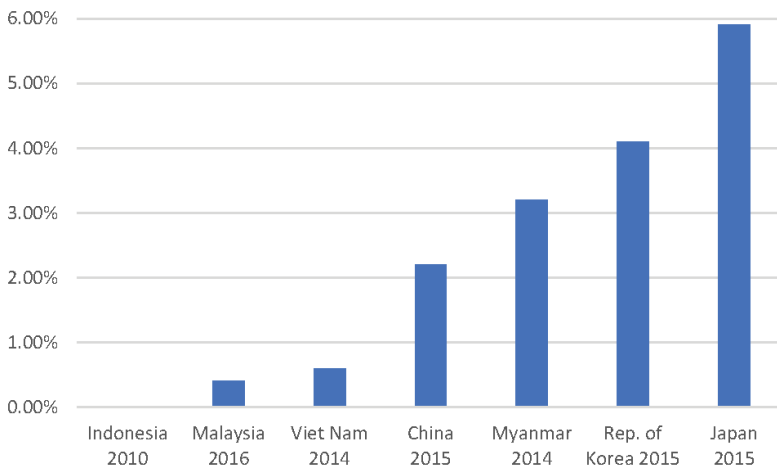

FIGURE 6-4 Percentage of older people living in nursing homes.
SOURCE: Staff generated graphic of data from Hayashi, 2019.

Nursing homes have a troubled past in many countries, rife with concerns about care quality and allegations of abuse, neglect, and exploitation (WHO, 2021). By their very nature, nursing homes limit the freedom of residents because they are required to keep residents safe; this was especially true during the COVID-19 pandemic. Nonetheless, many people will experience functional decline to the point that they can no longer receive care at home. Societies need to embrace new models of institutional care to ensure that older adults who need care in nonfamily settings can receive high-quality care.

In the United States, nursing homes that serve the poor are often underresourced, limiting such aspects of care as nurse-to-patient ratios. Research has found that nursing homes in the United States with higher percentages of Black residents are more often understaffed and receive deficient care and mistreatment ratings than nursing homes with lower percentages of Black residents (Harrington et al., 2017).

Funding for long-term care across countries is heterogeneous. In some high-income countries, including Japan, long-term care insurance covers all residents over age 65. In others, such as the United Kingdom, the cost of long-term care is based on income thresholds (OECD, 2021). In the United States, on the other hand, few people have insurance for long-term care, regardless of setting. Instead, Medicaid, the government-funded program for very-low-income people over age 65 (among other groups), guarantees payment for long-term care if delivered in a nursing home, but not if provided in the community. This approach limits direct government costs because many people will forego financial support for long-term care if it requires them to live in a nursing home. However, it also can impose significant burdens on families and costs to the broader economy, such as caregivers' inability to work.

Levers for Change

To achieve the vision set forth at the outset of this chapter, much about long-term care will need to change, ideally in a thoughtful and strategic manner. In 2011, IAGG made 10 recommendations—both structural and care-focused—for improving nursing home care. Although these recommendations were made more than a decade ago, the targeted areas remain problematic (Tolson et al., 2011).

In the future, it will be important to design or redesign both community- and facility-based care to meet the growing demand for long-term care globally (in Asia, for example, the demand is predicted to rise) (Hayashi, 2019). Many countries will also need structures for long-term care costs. Although paying for long-term care is a major concern and will require political will and trade-offs, determining what political and policy trade-offs countries should make is beyond the scope of this report.

As with all systems addressing the needs of older adults and younger people with disabilities, systems should be codesigned by all stakeholders, especially those with long-term care needs, following user-centered design principles and other tools, such as community-based participatory design (Ferreira and Gendron,

2011). Systems will need to include basics such as hygiene and health care, sustainable funding structures, and training for family and paid caregivers. Nursing homes will need more programmatic flexibility. Ideally, they will have fewer residents,[8] and the mixed population they currently house will be redistributed so that each group receives care in facilities better designed for their needs, such as rehabilitation centers, hospice, and memory care centers. New models, such as "care farms" piloted in the Netherlands, may become more widespread (Age Platform Europe, 2021). At the same time, the adverse experiences with COVID-19 in nursing homes globally may generate increased interest and investment in nursing home alternatives, such as hospital-based extended care units, home care, and other community-based care models. The COVID-19 experience also has highlighted the critical importance of strengthening the long-term care workforce.

Box 6-9 describes innovations in home-based, long-term care taking place in East Asia described in a report from the World Bank.

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[8] In the United States, larger nursing homes were more likely than smaller ones (Abrams et al., 2020).

BOX 6-9
Examples of Home Care Support in East Asia

"The Chinese government is implementing pilots in 42 cities (including Beijing, Chengdu, Hangzhou, and Shanghai) to provide comprehensive care services with a focus on innovation and applicability. Key elements of the pilot programs are establishing or strengthening community care centers to provide comprehensive services; conducting ability and needs analysis; purchasing services from the market or through service vouchers; using management information systems and information communication technology for monitoring and evaluation, quality control, and management; and encouraging involvement of volunteers in the provision of elderly care services."

"A further distinctive feature of LTC provision in East Asia and Pacific is the emergence of state-supported informal caring arrangements. The most notable example is the Thai scheme for informal carers in rural areas, which pays a monthly stipend equal to about US$20 to community-based carers who receive minimal training in supporting others in ADLs. Anecdotal evidence suggests that carers are often younger elderly people who have time and are likely to be more sensitized to the needs of older elderly. This program was nationally funded in the initial years, with the intention to shift financing to subnational authorities over time. Perhaps even more innovative is the growth of 'time banks' in China with support from local authorities in cities such as Hangzhou. Under these schemes, younger elderly provide home- and community-based support to other elderly people in need of care and in return generate a 'time credit' that compensates the caregivers with equivalent care time when they reach the stage of needing care."

SOURCE: Excerpted from World Bank, 2016, p. 235.

Box 6-10 describes a creative approach to supporting the long-term care needs of people in Canada.

Finding 6-11: Many countries around the globe are ill prepared to provide long-term care to the increasing number of older people expected to need it.

Finding 6-12: Family caregivers provide the majority of long-term care globally, but most have inadequate training and experience to provide quality care, especially for people with dementia.

BOX 6-10
Case Study: Wraparound Services in Canada's Senior Villages

Senior villages are campuses that include four colocated components: housing options, community supports, and a long-term care facility. In this study, the authors successfully uncovered the changes that occurred in these communities over time; their access to resources; their benefits; and their ability to address the needs of older populations who are seeking this unique overlap of home, community, and care.

"At an individual level, campuses increase local access to a coordinated range of health and social care services, supports and housing options. At an organizational level, campuses offer enhanced collaboration opportunities across providers and partners to improve consistency and coordination of care, and improved access to shared resources, expertise and infrastructure. At a system level, campuses can address a diversity of health, social, financial, and housing needs to help seniors avoid premature or inappropriate use of higher intensity care settings" (Morton-Chang et al., 2021, p. 1).

While the Canadian health care system focuses on the immediate needs for and responses to emergency health care issues, the senior villages themselves focus on prevention. This system provides "wraparound care" beyond standard health care delivery, including "inter-professional care planning, coordination and system navigation, senior-friendly housing options with supports," and more (Morton-Chang et al., 2021, p. 3). Similar to efforts in implementing these communities in Europe, senior village communities address inequitable housing access issues in Canada, as they are able to provide different levels of rent-geared affordable housing.

Ultimately, senior villages serve to meet the short- and long-term needs of the older populations in Canada. Through their array of provided resources and cross-divisional efforts, senior village communities efficiently address current and prevent future health and social issues.

SOURCE: Morton-Chang et al., 2021.

Conclusion 6-4: Family caregivers need training to provide adequate care to older persons; support for the emotional strain caregiving can bring; and, when possible, financial support, particularly for caregivers who must forego paid work to provide care to a family member.

Conclusion 6-5: Countries globally will need to build structures and financing models to provide long-term care to the growing number of older people predicted to have long-term care needs.

Recommendation 6-3: Governments should work with health and long-term care systems and researchers to develop strategies for making available culturally sensitive, person-centered, and equitable long-term care. To the greatest extent possible, strategies should honor people's preferences about care settings, enabling them to age within their home or community when possible. By 2027, countries should take first steps toward enacting strategies by implementing

a. **pilot programs to identify effective, accessible, affordable, and scalable models for delivering long-term care services and supports; and**

b. **models for providing financial and technological support, training, and career pathways for informal caregivers as well as the paid long-term care workforce.**

Metrics

Metrics for long-term care include the number and demographic characteristics of paid and unpaid caregivers; availability of facility-based care; and quality of long-term care, whether home- or facility-based.

Data Needs and Research Questions

Data will be needed to predict the future need for long-term care and model feasible approaches to providing that care. Data on the quality of long-term care will also be important to model given that demand increases the risk of poor quality. Needed as well are data on the quality of family caregiving and paid home care providers, and on the needs of family and paid caregivers. The International Long-Term Care Policy Network captures and makes available data on long-term care, which have been critical to understanding the challenges posed by COVID-19 to long-term care systems and policy responses from countries.[9]

Research on the following questions also is needed:

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[9] See https://www.ilpnetwork.org.

- best practices for integrating long-term care and social service providers;
- interventions with family and paid caregivers that enable them to provide the best care;
- efficacy of models for delivering and financing long-term care systems;
- best practices for engaging residents and people receiving home-based, long-term care in the codesign and coredesign of long-term care systems; and
- best practices for enabling residents of nursing homes to live life fully and with meaning and purpose.

KEY TARGET: HEALTH CARE WORKFORCE

It is important for providers of care for older people to have knowledge of the principles of geriatrics and the biology of these patients. But the workforce of geriatricians and allied health professionals with this knowledge is inadequate to meet current, let alone future, needs. The IOM report *Retooling for an Aging America* highlights the shortage of geriatricians, as well as social workers, physician assistants, registered nurses, and pharmacists who specialize or are certified in geriatrics (IOM, 2008). The report also emphasizes the shortage of nurses and nursing assistants in long-term care, which has only grown during the COVID-19 pandemic.

WHO's *World Report on Ageing* summarizes the inadequacy of geriatric training globally. A study of medical schools in 36 countries found that 27 percent—including 19 percent in high-income countries, 43 percent in economies in transition, and 38 percent in other countries—provided no training in geriatric medicine (WHO, 2015b). Medical trainees learn siloed, disease-based care, not the comprehensive biopsychosocial approaches needed to provide high-quality care to older people, especially those with complex needs. Other health care workers, especially those who provide direct services in low- and middle-income countries, also lack the training needed to provide high-quality care for this population.

A critical component of the care workforce for older people consists of those who provide personal care and other supports to people needing long-term care within and outside of facilities. This workforce is overwhelmingly female, often part of the informal economy, and typically very low-wage. The commissioners believe that improving the future of long-term care will require training, safety protections, and adequate pay for these workers.

Conclusion 6-6: The current geriatrics workforce is inadequate, and the need will grow. Plans to develop a geriatrics workforce for the future will be critical to ensuring adequate care for the growing number of older people globally.

KEY TARGET: GEROSCIENCE, TECHNOLOGY, AND BIG DATA INNOVATION

Innovations, along with a new understanding of aging, are emerging from geroscience, technology, and big data. These innovations have the potential to improve the lives of people living with the effects of age and chronic conditions.

Geroscience and Technology for Delaying Aging

Geroscience, which relies on interdisciplinary research teams, aims to describe the age-related biological mechanisms that cause chronic conditions, frailty, and functional decline, and to develop preventive and therapeutic interventions to slow the aging process and prevent or delay the onset of chronic conditions (Kennedy et al., 2014). The therapeutics identified through geroscience are not necessarily medical, but could include pollution reduction or increased physical activity, for example. Although geroscience has the potential to extend the life span, the commission chose to emphasize the "healthy" part of "healthy longevity"; thus, the goal is to improve the percentage of life in good health, not to further prolong the life span, recognizing that major disparities in life span exist globally.

In its focus on the underlying drivers of aging, geroscience differs from traditional biomedical research, which focuses on one disease at a time and often is conducted with carefully constructed study samples that are not representative of the larger population. For example, a clinical trial investigating a medication for chronic kidney disease may exclude patients with other chronic conditions, and in so doing will exclude the more than 80 percent of people with chronic kidney disease who have other chronic conditions (Hajat and Stein, 2018). In contrast, epidemiologic studies are conducted with population samples that represent the general population and, working in concert with geroscience, can combine chronic disease and aging research to explain how the human body ages and declines over time.

Prevention and care targeting aging pathways are predicted to have very different, and better, outcomes compared with the current discrete disease-focused approach. Early research suggests that in contrast with treating chronic conditions as discrete pathologies, interventions to delay aging would also increase resistance to multiple chronic conditions. Results of a study comparing health and economic returns from delaying aging and from treating chronic conditions separately suggest that the latter approach is a net negative (Goldman et al., 2013). While treating chronic conditions individually may enable people to live longer, they still suffer from other age-related chronic conditions and disabilities that develop from the same underlying age-related mechanisms that caused the original condition.

Discoveries in geroscience are changing the way people view aging, from the past view that aging comes with inevitable long periods of poor health toward

an optimistic view that targeting aging rather than single diseases can shorten periods of poor health in later life. Geroscience will be even more powerful in supporting healthy longevity when combined with the availability of more data and advanced analytics and integrated into both public health and medical care technology.

Care Delivery Technology

Digital technologies have the potential to play an important role in integrated care delivery for older people by enabling early detection and management of chronic diseases and functional impairments. Digital care technology is most effective when experts across sectors, such as engineers, medical professionals, and scientists, use human-centered design techniques to engage older adults throughout the design process. This codesign ensures that the final products meet older adults' diverse needs. Device designs that are adaptable and can be personalized as circumstances change would provide older adults with the opportunity to become familiar and comfortable with the technology.

Telemedicine

Telemedicine is used to examine and diagnose people in their own homes or another site when in-person visits are challenging or impossible. Virtual care delivery enhances the accessibility, quality, efficiency, and cost-effectiveness of health care services (WHO, 2010b). During the COVID-19 pandemic, the rapid shift to telehealth, enabled by the removal of regulatory barriers that had been in place, allowed for continuity of care when in-person visits could not take place (ITU, 2021).

Telemedicine is widely accepted by older people. In lower- to middle-income countries, older adults can benefit from telehealth care in remote areas that lack a functioning medical center (WHO, 2010b). Telemedicine also allows patients with complex needs to meet with psychologists who may not work at nearby on-site facilities. In sub-Saharan Africa, for example, the Mental Health Preparedness and Action Framework suggests that telemedicine can be used more widely, first through the training of community health workers and volunteers, and second through an increase in mobile health services for mental health support in areas where psychologists are not widely available to see patients in person (Jaguga and Kwobah, 2021).

Telehealth and Remote Monitoring

Telehealth encompasses a broad range of electronic and telecommunications services and technologies used for purposes such as remote patient monitoring and health promotion messaging.

Wearable technologies, a form of telehealth, are increasingly being used to monitor older patients' health and provide real-time feedback that informs both them and their providers about their health status and needs. The data produced by these devices are a more representative measure of a patient's physical status than snapshot data collected from intermittent medical appointments. Most important, these devices can be used to study physical and cognitive issues that may go unnoticed with conventional monitoring processes.

The rising number of people with Alzheimer's disease has sparked interest in the possibility of using wearable technology to capture cognitive, sensory, and motor changes that can be measured before symptoms of the disease become obvious. Research suggests that gait speed, stride length, and gait symmetry decrease at an early stage of Alzheimer's disease and precede signs of cognitive impairment. Inertial measurement unit sensors on smartphones detect changes in routine walking movements. The gait metrics they produce, coupled with changes in verbal and visual skills, provide a composite analysis of predictors of Alzheimer's disease to enable a proactive approach to treatment.

Wearable activity trackers also can provide baseline data and goals for physical activity, along with a platform for accountability, such as a personal dashboard, that may otherwise be difficult for older adults to access. Older adults thereby have a visible reminder to increase physical activity that supports healthy longevity and enables self-monitoring and feedback (Kononova et al., 2019). Box 6-11 describes the use of technology in developing a disaster-resilient community in Japan.

BOX 6-11
Case Study: Tago-Nishi Disaster-Resilient Community

Tago-Nishi, described in detail in Chapter 4, has been a pilot for Intelligent Knowledge as a Service (iKaaS). For older adults in the community, the Sendai Green Community Association seeks to monitor behaviors to notify senior citizens, as well as their families and caregivers, of their choices to ultimately avoid long-term nursing care. Through the use of wearable accelerometers, physical activity information can be delivered to the cloud and into an artificial intelligence algorithm. Combined analyses of environmental and personal health information can help inform individuals on how they can safely and effectively continue physical activity and maintain mobility. In the second evaluation of this health support service for the iKaaS project in 2017, researchers found that 87 percent of health support workers agreed that the identification of inactive residents was useful. Additionally, more than 70 percent of health support workers expected physically inactive residents to participate in social events. With more than 30 million older people living in Japan, health care services based on the Internet of Things devices hold great potential for improving quality of life.

SOURCES: ESCAP, 2012; Hashimoto et al., 2015; iKaaS, 2022; Sekisui House, 2021.

Big Data, Advanced Analytics, and Healthy Longevity

At the same time that geroscience has made leaps in understanding of aging processes, the world has entered a period of big data. The term "big data" refers to the vast amount of data about people that is being collected and stored across all domains of life, along with the use of AI to capture, process, store, and analyze the data. In the context of understanding the multiple dimensions of health, data in people's health records are relevant. Beyond what traditional health records contain, other relevant data include factors such as the location of a person's house (e.g., its proximity to a chemical plant or oil refinery) and the person's education, net worth, marital status, gender, social media posts suggesting tobacco or alcohol use, and physical activity (as recorded by tracking apps). In the United States, health insurance companies are already using nonmedical data sources to make decisions, typically without the person's knowledge (Allen, 2018).

On their own, these expansive data are of little value, but AI has rendered them far more valuable than in the past. A combination of unstructured AI and hypothesis-driven research is expected to enable the precision medicine and precision public health described earlier in this chapter. Unstructured AI detects patterns and clusters that are complex, multidimensional, and subtle, and that would be very difficult to identify using hypothesis-driven quantitative research methods.

In health, AI is being used for natural language processing (e.g., to read open text in health records), robotics, computer vision, pattern detection (e.g., reading X-ray images), and fall detection (Loveys et al., 2022). Researchers are investigating the use of AI in long-term care to support the long-term care workforce and improve access to data and information. In their recent systematic review of the literature on AI uses in long-term care, Loveys and colleagues (2022) concluded that interventions were somewhat acceptable but the evidence for their effectiveness was mixed when measured against desired outcomes.

The use of big data carries risks, however. First, unstructured AI can identify statistical "noise," a term that denotes a meaningless statistical association. Second, data reflect the environment in which they are generated, so data captured in a community characterized by bias against a minority population will reflect that bias. In the United States, for example, a health insurance company restricted African Americans' access to a home-based care program because the algorithm used to determine eligibility was developed using data that incorporated historical barriers to health care (Obermeyer et al., 2019). Finally, some "black box" algorithms are so complex that the factors driving decisions within them cannot be identified, creating the risk that troubling decisions made within an algorithm will be hidden. Consequently, while unstructured AI can be highly effective for generating hypotheses to be tested, findings must be validated using hypothesis-driven research before they can be used to create algorithms to support precision medicine or precision public health (Hulsen et al., 2019).

Finding 6-13: The technologies emerging across the health sector—including geroscience, precision medicine and precision public health, and remote monitoring to detect health threats earlier than is currently possible—offer great promise for advancing healthy longevity.

Conclusion 6-7: Technology and artificial intelligence will drive health systems of the future, but privacy protection and transparency will be essential to ensure that they are acceptable to people and help promote equity.

Research Questions

In addition to the efficacy and acceptability of AI use and interventions across health systems, Kennedy and colleagues (2014) suggest the following research goals for geroscience:

- "Continuum from psychological to molecular stresses
- Differentiate hormesis from toxic stress
- Better align human and animal studies
- Biomarker development: chronologic versus biologic aging
- Link age-related environmental inputs to epigenetic signatures
- Test small molecules that regulate enzymes controlling epigenetic events
- Differentiate adaptive and maladaptive inflammatory responses
- Define age-related inflammatory sources and their systemic effects
- Determine how obesity and metabolic dysfunction alter inflammation with age
- Generate systems-level understanding of the types of macromolecular damage and their roles in chronic disease states
- Understand how stochastic damage influences the variability of aging
- Define role of signal transduction pathways linked to metabolism in the aging process
- Understand contribution of circadian clocks to aging and metabolism
- Connect metabolic dysfunction with tissue-specific decline in aging
- Identify proteostatic pathways that are overwhelmed in specific chronic disease states
- Examine crosstalk between proteostasis machineries
- Understand non-cell-autonomous signaling and activation of proteostasis pathways
- Determine whether declining adult stem cell function drives aging and chronic disease
- Examine how aging and associated disease impair adult stem cell function

- • Determine how macromolecular damage accumulates in aging adult stem cell pools" (Kennedy et al., 2014, p. 711)

CONCLUSION

As more people live into older ages, a corresponding increase in demand on health systems can be anticipated. While for many people, interventions and recommendations discussed in Chapters 4 and 5 can ideally delay biological aging and increase years of healthy life, others will continue to rely on public health, health care, and long-term care for support as they age and experience the onset of chronic conditions. Current care systems are disjointed, however, and a rebalancing of investment across the care spectrum will be necessary to ensure that adequate support and priority are given to preventing disease and promoting health, not just responding to illness. To this end, the focus will have to shift to primary, integrated, person-centered care, with increased investment in geriatrics and a health care workforce with the appropriate knowledge to care for older adults. Finally, geroscience and innovations in health data hold great promise for improving understanding of aging and health and enhancing access to care for those with limited mobility. Together, these improvements can enhance the quality of life for older adults as they live longer lives.

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7

A Global Roadmap for Healthy Longevity

Older age and longer lives bring new opportunities for meaningful and purpose-driven roles and responsibilities, including roles in solving many societal challenges. The sheer scale of the demographic changes currently under way means that the proportions of older people are increasing in virtually all countries, with 16 percent of the global population projected to comprise people aged 65 and older by 2050 (UN DESA, 2019). The commission asserts that societies can thrive in this new demographic order by improving health and building new roles and expectations for older people. In conducting this study, the commission found that healthy longevity requires not only good health[1] but also a fostering of social and environmental enablers, as described in Chapters 3 through 6. Many of the goals and recommendations in this report focus on older people because improving the lives of older people improves the lives of all people, and the goal of healthy longevity offers an expanded rationale for investments. Moreover, for younger people to have optimism about their futures, they need to see that their later years can be characterized by well-being, engagement, meaning, and purpose. These investments, combined with the assets and prosocial goals of unprecedented numbers of older adults, can achieve healthy longevity for individuals and societies. The commission thus concludes that healthy older age can bring to societies around the world immense capabilities to thrive, contribute to the successes of youth, and strengthen intergenerational cohesion.

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[1] In this report, health is defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1946), which includes the ability to function and participate fully in society.

221

CREATING A GLOBAL ROADMAP FOR HEALTHY LONGEVITY

In this report, the commission presents its vision for 2050 with a goal of inspiring all actors—from leaders to individuals—around the world. No country has achieved sustained healthy longevity, but the evidence now suggests this is a clear opportunity. While the scientific evidence for precisely how to do so is unproven, the empirical evidence and studies reveal promising paths. This evidence, described in Chapters 3 through 6, serves as the basis for the commission's findings, conclusions, and recommendations. The commission emphasizes urgency of initiating planning and first-step actions, including proactive experimentation and innovation guided, not limited, by the evidence. It will also be critical to monitor progress using rigorous evaluation, metrics, and continuous improvement approaches. If societies wait for rigorous academic evidence before acting, it is likely that little progress can be made efficiently toward achieving the commission's vision for healthy longevity.

Because today's societies were not designed for longer lives, realizing this vision will require long-term and large-scale societal investments in the roles, systems, organizations, and norms needed to support healthier, longer lives. Investments should focus on creating the supporting structures that are necessary for healthy longevity. Countries and communities are at different stages in developing these structures and therefore will likely interpret and implement the recommendations in this report based in part on the availability of resources and the age composition of populations. The commission's recommendations for actions in the next 5 years are flexible, enabling actors to identify structures that are needed within their country, locality, or organization and to take actions necessary to build new or shore up existing structures (see Figure 7-1). Many of the recommendations focus on older adults because, as stated above, improving their health and well-being contributes to the health and well-being of all people; healthy longevity requires life-course investments; and to have optimism for their later lives, young people need to see older people who are engaged, thriving, and productive to counter the narratives of older people as disabled and dependent. Finally, the achievement of healthy longevity for all will require the resolution of health disparities at every age.

The commission's recommendations comprise levers for change within and across work and education; social engagement; and investment in transforming social protections, the physical environment, and health systems. The first-stage, actionable recommendations of the commission are based on evidence and the combined expertise of the commissioners and are designed to catalyze transformational change. The commission maintains that these interventions are achievable within 5 years of this report's release (i.e., by 2027) unless otherwise stated. This 5-year target will be useful to countries as they assess progress made toward goals of the United Nations (UN) Decade of Healthy Ageing (2021–2030) and

Overarching Principles for Healthy Longevity

1. People of all ages, particularly older adults, reach their full potential to live life with good health, functioning, meaning, purpose, and dignity.
2. Societies enable the best health and functioning that individuals at all ages are capable of attaining.
3. Societies reduce disparities and enhance equity within and among countries to realize the well-being and contributions of all people, including those of older ages.
4. The human, financial, and social capital of older people is realized for the benefit of all of society.
5. Societies use data and meaningful metrics to track the achievement of outcomes and guide decision making.

Recommendations for the Next 5 Years		Supporting Structures to Achieve the Goals		Long-Term Goals for Longer and Healthier Lives in 2050
2022 - 2027		**2022 - 2050**		**2050**

FIGURE 7-1 A roadmap for achieving healthy longevity.

develop plans for addressing remaining challenges. Once implemented, these first-stage recommendations can lead to the development of supporting structures to achieve the goals articulated for longer and healthier lives.

The commission recognizes the heterogeneity of countries around the world—each country has its own cultures, populations, systems, and resources and thus will have different starting points and priorities. Critical to global efforts are the relationships of unequal economic and political exchange that characterize many low- and middle-income countries, which determine and limit their economies, lead to health disparities and hierarchy of opportunity from old to young, and shape the resources they can marshal to invest in healthy longevity. Importantly, the commission does not suggest an order of importance for the Vision 2050 goals, as all are necessary, in concert, to extend the number of years lived in good health. Countries will need to address each goal based on their available resources and current investments and the overall health of their populations. Similarly, the commission refrained from prescribing detailed mechanisms for enacting the necessary policies given the unique contexts of each country, instead offering this overarching roadmap to guide country-specific paths to healthy longevity. The commission also offers two enabling recommendations that would catalyze action: a call to action and data to measure healthy longevity.

AN ALL-OF-SOCIETY CALL TO ACTION

Applying a complex systems approach, the commission recognizes that innovation in any one sector will not lead to a transformation toward achieving healthy longevity. Actions targeting the economic longevity dividend, social infrastructure, physical environment, and health systems will all be necessary, as discussed in Chapters 3 through 6. Implementing the commission's recommendations will require an all-of-society approach, involving transformations in every sector of a nation.

Similarly, the commission calls on a multitude of actors and stakeholders to take action. Actors include governments, nongovernmental organizations (NGOs) and multilateral organizations, the private sector, local and community organizations, and researchers, as well as leaders and individuals (see Figure 7-2). Each group of actors has a unique and critical role to play; collectively, these actors have a shared accountability for achieving healthier, longer lives. Government agencies at the international, national, regional, and local levels each have distinct, important roles in policy development and overarching leadership. NGOs and multilateral organizations bring stakeholders together within and across countries, providing access to resources and guidance. The private sector, including businesses, unions, and professional societies, can translate policies and values into programs that will motivate and create incentives for individuals. Researchers can provide the evidence for what has worked and how to do better.

FIGURE 7-2 Relevant actors for an all-of-society approach to healthy longevity.

Religious institutions can help guide a community's culture and values and can be used to mobilize community action. And individuals, their families, and communities must take responsibility for engaging in the opportunities thus provided to help drive the years lived in good health to approach life span and to build the opportunities for meaningful and productive engagement that people may want. Transformation of this complex system has to be approached from both the "bottom up" and "top down," with dialog among citizens and stakeholders.

The commission believes strong commitments to healthy longevity by governments are essential to stimulate and initiate actions by each sector and set of actors. Governments can lead by recognizing that humanity has an opportunity now to plan and prepare for the demographic shifts toward longer life expectancy and a larger proportion of older people. Specifically, governments can commit to enabling healthy longevity, creating a vision and agenda that explain how long lives are beneficial for all ages; communicating the value older people can bring; and building the necessary systems, environments, and opportunities.

> **Recommendation 7-1: By 2023, governments should establish calls to action to develop and implement data-driven, all-of-society plans for building organizations and social infrastructure needed to enable healthy longevity.**

The commission recommends that governments initiate processes now that will lead to the establishment of calls to action by 2023. Countries should begin implementing the plans resulting from those calls to action by 2027. Whenever possible, these all-of-society plans should connect to and be integrated with and/or transform existing policies and services. At a minimum, plans should include synthesis or coordination of policy responses in the areas identified in this report and indicate where investments will be made. For example, one component of a plan could involve governments working with the private sector to develop innovative, scalable, and sustainable societal initiatives designed to facilitate working longer for those who want to; enable social protections; and catalyze intergenerational connections, social capital, and productive engagement of older people. Communities could work together to address how cross-sector changes, such as actions to combat climate change, can be implemented efficiently and leverage any shared resources. Communication campaigns could be conducted to urge older adults to contribute to younger generations' success and younger generations to contribute to prior generations' well-being. As described in Chapter 3, the commission believes that the resulting social and economic capital from these efforts will generate returns on investment.

Ongoing research will be needed to better understand how to achieve healthy longevity equitably in each of the above areas and in culturally appropriate ways across domains. In the near term, all-of-society plans can create healthy longevity, and to support older people will benefit the success of future generations by increasing the amount of human, social, and economic capital, which in turn will

expand the economy and help fund future efforts to promote healthy longevity. While strategic action plans for aging societies exist in many countries, the commission believes many are not heeded because the challenge is viewed as applicable for a single sector or age group, and changing complex systems requires immense effort and political will. There also has not been wide acknowledgment of the value to people of all ages of viewing healthy longevity across the life course. While financing and political will are beyond the scope of this study, the commission argues that healthy longevity can be achieved only by aligning forces and taking collective action across sectors.

DATA TO GUIDE DECISION MAKING

Data and metrics are needed to measure progress toward achieving healthy longevity at both the individual and population levels, but current metrics do not adequately capture the key domains addressed in this report. A core set of metrics thus needs to be collected to enable evaluation of progress toward increasing years lived in good health and achieving the goals of healthy longevity. Most useful, where possible, would be direct measures reflecting the impact of differences in services and environments across countries. Useful as well, where relevant, would be appropriate country- or region-specific metrics able to capture particular contexts and forms that healthy longevity and requisite investments will take. Leadership will be critical for identifying metrics all countries can use. International bodies and professional organizations will have essential roles in coordinating efforts to identify meaningful measures of outcomes.

> **Recommendation 7-2: International agencies, led by the World Health Organization, should work together and in concert with countries to reach consensus on metrics and surveillance mechanisms for routine data collection to measure healthy longevity. These data should be used to guide decision making with respect to prioritizing investments and monitoring outcomes and progress.**

The commission calls on the World Health Organization (WHO) to lead this effort while working with other multilateral organizations, such as other relevant UN agencies (e.g., UN Department of Economic and Social Affairs) and the World Bank. As an agency of the United Nations, WHO has the objective of "the attainment by all peoples of the highest possible level of health" (WHO, 1946). Although their core missions are not to collect data, WHO and other aligned agencies can use their ability to convene countries and peoples from around the world to mobilize efforts toward identification of a global set of metrics for measuring healthy longevity and progress toward this goal. These metrics need to capture not only the health of populations but also ways to evaluate human and social capital and societal returns on investment. Measuring and monitoring

progress along these measures will allow the world to better harness the human, social, and economic capital of populations. New metrics and systems of monitoring will likely be required.

As no single measure of healthy longevity adequately addresses the array of enablers identified in this report, a core set of metrics and measures consistent across countries would facilitate the identification of outcomes and compilation of best practices, effective interventions, and policies that promote healthy longevity. Importantly, global metrics can allow countries to benchmark their performance, characterize return on investment, and compare across countries to assess the success of interventions. Core data should be made publicly available to the extent possible to enable decision making on next-stage investments and research needs. Individual-level data will be most useful if stratified by gender and age bands across the life span.

Data collection at the population level is resource intensive but important to enable continuous assessment and evaluation that can aid in identifying opportunities for intermediate change. Countries will need to consider efficient methods for gathering high-quality data. For example, digital data collection could be more efficient than traditional methods and yield more robust data.

TRADE-OFFS

Making investments to achieve healthy longevity requires making trade-offs. Individuals and families, communities, and societies must weigh the benefits and costs of prioritizing healthy longevity. Similarly, each society will need to align its decisions with the vision of this report while remaining cognizant of local factors such as the relative age of its population and available funding.

Also important to note are the existential societal challenges that societies will face, such as climate change, unsustainable inequity, and wars. In the context of finite resources, the realities of political will, and other efforts such as the pursuit of the UN Sustainable Development Goals (UN, 2021), priorities will need to be continuously evaluated and investments refocused. The commission contends that healthy longevity will generate returns on investment and provide immense social and individual benefits, and that a focus on healthy longevity will better enable success in other areas.

CONCLUSION

Health is complex and the result of a multitude of factors, requiring attention not just to health systems but to all socioeconomic determinants of health. It is imperative that countries act now to achieve healthy longevity as the human life span is extended. By taking an all-of-society approach, countries can seize the opportunity to align efforts addressing all of these factors to increase the number of years lived in good health.

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Appendix A

Summary of the Global Roadmap for Healthy Longevity

This appendix summarizes a global roadmap for achieving the vision of healthy longevity. The evidence base for the roadmap is contained within the chapters of the report. The commission defines healthy longevity as the following:

> *In healthy longevity, years of good health approach the biological life span, with physical, cognitive, and social functioning that enables well-being.*

Societies achieving healthy longevity will benefit at large scale from enhanced human capital and contributions from older people. This will improve economic and societal well-being, as well as the success of young people.

The commission offers five overarching principles for healthy longevity:

1. People of all ages, particularly older adults, reach their full potential to live life with good health, function, meaning, purpose, and dignity.
2. Societies enable the best health and functioning that individuals at all ages are capable of attaining.
3. Societies reduce disparities and enhance equity within and among countries to realize the well-being and contributions of all people, including those of older ages.
4. The human, financial, and social capital of older people is realized for the benefit of all of society.
5. Societies use data and meaningful metrics to track the achievement of outcomes and guide decision making.

229

Given that many sectors of society influence the ability of societies and individuals to achieve healthy longevity, the commission has formulated specific systems goals for achieving the overarching principles for healthy longevity (see Table A-1). Examples of specific structures and targets needed for achieving the goals are also included. To provide concrete suggestions for healthier, longer lives, the commission recommends a series of actions to be taken in the next 5 years.

TABLE A-1 Summary Table of the Global Roadmap for Healthy Longevity

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Cross-cutting		
		Recommendation 7-1. By 2023, governments should establish calls to action to develop and implement data-driven, all-of-society plans for building organizations and social infrastructure needed to enable healthy longevity.
		Recommendation 7-2. International agencies, led by the World Health Organization, should work together and in concert with countries to reach consensus on metrics and surveillance mechanisms for routine data collection to measure healthy longevity. These data should be used to guide decision making with respect to prioritizing investments and monitoring outcomes and progress.

TABLE A-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Longevity Dividend		

Key Targets:
- Work and Retirement
- Volunteering
- Lifelong Education and Retraining

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Goal 1. Economic and social benefits generated by people living, working, volunteering, and engaging longer Goal 2. Social infrastructure, institutions, and business systems that enable safe and meaningful work and other community engagement at every stage of life	• Increased older adult participation in the paid workforce and volunteer roles to maintain individual and societal economic equilibrium with population aging • Incentives to recruit and retain older workers to increase workforce participation, emphasizing the worker's preferences, strengths, and capabilities • Policies and incentives to keep older people working and remove barriers to remaining in or rejoining the workforce • Formal programs to provide volunteers with meaning and purpose through opportunities to benefit communities and the next generation	Recommendation 3-1. Governments, in collaboration with the business sector, should design work environments and develop new policies that enable and encourage older adults to remain in the workforce longer by a. providing legal protections and workplace policies to ensure worker health and safety and income protection (including during periods of disability) across the life course; b. developing innovative solutions for extending legal and income protection to workers participating in alternative models of work (e.g., gig economy, informal sector); c. increasing opportunities for part-time work and flexible schedules; and d. promoting intergenerational national and community service and encore careers.

TABLE A-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Goal 3. Education and training opportunities that promote participation in lifelong learning and growth	• Development and adoption of a range of innovative and age-appropriate pedagogical approaches that work for people of all ages • Expanded access to secondary education, vocational training, and higher education to train and upskill workers of all ages	Recommendation 3-2. Governments, employers, and educational institutions should prioritize investments in redesigning education systems to support lifelong learning and training. Governments should also invest in the science of learning and training for middle-aged and older adults. Specifically, employers, unions, and governments should support pilots that allow middle-aged and older adults to retool for multiple careers and/or participate as volunteers across their life span through the development of such incentives as a. grants or tax breaks for employers to promote retaining and upskilling of employees (e.g., apprenticeship programs, retraining of workers in physically demanding jobs to enable them to engage in new careers in less demanding jobs); b. special grants to community colleges and universities for the development of innovative models that target middle-aged and older students to support lifelong learning; and c. grants to individuals for engaging in midcareer training.

TABLE A-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Social Infrastructure		

Key Targets:
- Prosocial Strengths of Older People
- Ageism and Age Discrimination
- Social Inclusion
- Financial Security in Retirement
- Digital Literacy

Goal 4. Social cohesion augmented by intergenerational connections and the creation of opportunities for purposeful engagement by older people at the family, community, and societal levels	• Laws and policies to eliminate age-based discrimination • Public information campaigns promoting the value of older people and attacking stereotypes • Multigenerational advocacy to fight age discrimination to accomplish shared goals • Multigenerational approach to policy and action to strengthen social cohesion, reduce loneliness	Recommendation 4-1. Governments should develop evidence-based, multipronged strategies for reducing ageism against any age group by a. collaborating across sectors—for example with local governments, industry, and nongovernmental organizations—to launch public information campaigns that highlight the value of older people to society; b. developing public and private partnerships to create programs, connected intergenerational communities, and innovative models that enable all people to contribute to society; and c. developing legal protections for the rights of older people and ending age-based segregation and discrimination (e.g., legal barriers related to housing, policies that discourage work at older ages).

TABLE A-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Goal 5. Social protections and financial security that mitigate the effects of financial vulnerability at older ages	• Pension and social protection systems that include people outside the formal economy • Programs promoting individual savings and financial literacy • Access to secure banking systems and investment opportunities	Recommendation 4-2. By 2027, all governments should develop plans for ensuring basic financial security for older people. a. For countries without retirement income systems, introduce support for older people with no or subsistence-level income. b. For countries with emerging retirement income systems, increase security for low-income older people. c. For countries with robust retirement income systems, identify evidence-based models for strengthening financial security across the life course. Recommendation 4-3. To improve financial security in retirement, governments and employers should develop strategies for increasing financial literacy and mechanisms for promoting pension contributions, self-funded pensions, and lifelong savings.

TABLE A-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Physical Environment Enablers		

Key Targets:
• Housing
• Public Spaces and Infrastructure
• Transportation
• Digital Technologies
• Climate Change and Environmental Hazards

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Goal 6. Physical environments and infrastructure that support functioning and engagement for people at older ages	• Inclusion of older people in codesign and user-centered design of the built environment • Public spaces that promote social cohesion and intergenerational connection, while also encouraging physical activity • Age-friendly community and housing design protocols that enhance access to food, transportation, social services, and engagement • Programs to mitigate the effects of environmental emergencies on older people • Reduction of air pollution	Recommendation 5-1. Governments and the private sector should partner to design user-centered and cohesion-enabling intergenerational communities for healthy longevity. Initiatives should include a. at the city level, developing and implementing mitigation strategies to reduce the negative effects of the physical environment (e.g., air pollution and climate events such as flooding and hurricanes/typhoons) on older adults; b. at the neighborhood level, promoting and measuring the impact of innovation and policy solutions for healthy longevity, intergenerational connection, and cohesion; c. at the home level, updating physical infrastructure to address affordability, insufficiencies, and inefficiencies in housing stock, as well as support autonomy and social connection; d. making broadband accessible and reducing the digital divide (e.g., usability of and willingness to adopt technology) within the context of each community; and e. designing public transportation options, including solutions that address first-/last-mile transportation needs, that can be provided to companies, foundations, and local governments for implementation.

continued

TABLE A-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Health Systems		

Key Targets:
- Chronic Conditions
- Public Health
- Health Care Delivery
- Long-Term Care
- Health Care Workforce
- Geroscience, Technology, and Big Data Innovation

Goal 7. Integrated public health, social service, person-centered health care, and long-term care systems designed to extend years of good health and support the diverse health needs of older people	• Integration across public health, health care, long-term care, and social services • Interventions at the population and individual levels to reduce underlying risk factors for aging and chronic conditions • Close collaboration with social service providers, workplaces, and other entities that can promote health • Data and analytics systems for surveillance, precision public health, and assessment of the efficacy of interventions	Recommendation 6-1. To achieve the goal of the best possible health for older people, governments, over the next 5 years, should develop strategies to increase investments in robust public health systems that build and lead collective actions for promoting health at the population level and across the life course. a. Investments in public health systems may require governments to rebalance investments in health care and public health. b. Public policies should create incentives for individuals, employers, and communities to engage in prevention and wellness activities. c. All countries should establish 5-year targets for preventive health and measure progress toward those targets.

TABLE A-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
	• Integrated person-centered care, including care coordination • Primary care • Comprehensive and shared health records and a goal-based care plan • Collaboration with social services to address social determinants of health • Primary care systems that provide preventive screening, address risk factors for chronic conditions, and promote positive health behaviors • Geriatrics workforce that can adequately care for older people globally • Palliative and hospice care	Recommendation 6-2. Health care systems should shift to enabling healthy longevity. To catalyze such a shift, actions to be taken by 2027 include the following: a. Health systems, in concert with communities and the people they serve, should adopt affordable, accessible, culturally appropriate models, including geriatric care models, for providing person-centered, integrated care for older people facing functional limitations, multimorbidity, frailty, and complex care needs. b. Governments should develop plans to align health care payment and reimbursement systems with healthy longevity outcomes. c. Health care and long-term care systems should begin to develop the infrastructure needed to create integrated continua of care supported by interoperable data systems. d. Health care systems should measure care outcomes based on patient goals and preferences and patient-reported outcomes. e. Relevant licensing and certification bodies should ensure that all health care providers receive training in how the physiology and psychology of aging affect diagnosis and treatment of older patients. f. Governments, professional societies, and health systems should provide incentives to develop and/or maintain a geriatrics workforce, including allied health workers, to focus on older adults with multimorbidity, geriatric syndromes, and declining physical and cognitive functioning. g. Governments, employers, health systems, and communities should empower citizens with the tools and data needed to manage their own health.

TABLE A-1 Continued

Long-Term Goals for Longer and Healthier Lives in 2050	Examples of Supporting Structures	Recommendations for the Next 5 Years
Goal 8. Quality long-term care systems to ensure that people receive the care they require in the setting they desire for a life of meaning and dignity	• Policy and funding prioritizes care delivery in the setting the person chooses, to the extent possible; respects individual autonomy and maintains dignity; and attends to care quality and the risk of abuse, neglect, and exploitation • Care and social supports addressing all needs, including meaning and purpose • Supports for families and family caregivers when providing long-term care while making formal care available when needed • Technology to support caregivers and people needing care by providing monitoring that allows privacy	Recommendation 6-3. Governments should work with health and long-term care systems and researchers to develop strategies for making available culturally sensitive, person-centered, and equitable long-term care. To the extent possible, strategies should honor people's preferences about care settings, enabling them to age within their home or community when possible. By 2027, countries should take first steps toward enacting strategies by implementing a. pilot programs to identify effective, accessible, affordable, and scalable models for delivering long-term care services and supports; and b. models for providing financial and technological support, training, and career pathways for informal caregivers as well as the paid long-term care workforce.

Appendix B

COVID-19 and Older Adults

With its critical impacts on many populations, especially older adults, the COVID-19 pandemic has sounded a global wake-up call. Advanced age increases a person's risk for contracting COVID-19, regardless of variant type. Older individuals with age-related chronic conditions, including type 2 diabetes, hypertension, and cardiovascular disease, are at particular risk for contracting COVID-19 and are much more likely than their younger and healthier counterparts to end up in intensive care and to die (CDC, 2021a). Whether in the community or in long-term care facilities, public health care measures—including proactive screening for symptoms common in older people and adherence to personal protective measures, such as mask-wearing, physical distancing, and handwashing—can protect older people (CDC, 2021a). However, the implementation of these measures has varied across locations, offering inconsistent levels of protection.

COVID-19 has impacted aging populations in other ways as well. In doing so, it has revealed gaps, inequities, and cultural and system-level challenges that can lead to poor health outcomes for far too many people.

This appendix outlines the factors associated with the pandemic that have impacted life expectancy and driven excess morbidity and mortality among older adults; highlights the pandemic's impacts on health systems; and describes its social, behavioral, and economic effects. It concludes with lessons learned from the pandemic in areas relevant to older adults, which, moving forward, can be built on for improving future responses to emergencies.

239

THE PANDEMIC'S IMPACT ON LIFE EXPECTANCY

The COVID-19 pandemic has set back years of progress toward increasing longevity, although the effects have varied considerably around the world, with life expectancy decreasing by 1.5 years from 2019 to 2021 in the United States while rising in other countries (CDC, 2021b; World Bank, 2021). In Japan, for example, mortality rates from COVID-19 were lower than those of many other countries, and during the same period (2019–2021), mortality rates from pneumonia and cancer improved; the result was a 0.2 percent increase in life span for both men and women (Ishida, 2021).

Data from the Centers for Disease Control and Prevention show that life expectancy among American adults has dropped by around 1.5 years, the largest decline since World War II (CDC, 2021b). However, life expectancies for U.S. Black and Latinx populations are estimated to have declined by 2.10 and 3.05 years, respectively—several times more than the reduction of 0.68 years for Whites (Andrasfay and Goldman, 2021; Arias et al., 2021). These findings highlight the disproportionate burden of the pandemic on Black and Latinx Americans, reflecting structural inequities that increase the risk of exposure to the virus and mortality.

Outside the United States, several studies have used modeling to predict the impact of the COVID-19 pandemic on life expectancy, as mortality data for 2020 are still being gathered. In countries experiencing more severe COVID-19 outbreaks, decreases in life expectancy are projected based on available 2020 data. For example, relative to 2019 levels, life expectancy at birth in England and Wales fell by 0.9 years for females and 1.2 years for males (Aburto et al., 2021). In Italy, life expectancy at birth (not broken down by sex) fell by 1.2 years between 2019 and 2020 (OECD, 2021). In Brazil, a decline in life expectancy of 0.94 years as of 2020 is estimated (Castro et al., 2021). A model produced by the University of California, Los Angeles, showed estimated reduction in life expectancy between 2019 and 2020 by 2.2 years in Panama, and 2.09 years in Peru (Heuveline and Tzen, 2021). Another phenomenon was observed in South Korea, where deaths in 2020 exceeded live births for the first time, with high death rates among those aged 90 and above (Yeung and Bae, 2021). While countries across the globe saw increases in life expectancy over the past decade, the COVID-19 pandemic has significantly altered life expectancy trajectories.

FACTORS DRIVING EXCESS MORBIDITY AND MORTALITY

Biological and Physiological Factors

Older adults respond to viruses including COVID-19 differently from younger adults. These differences are complicated by the presence of chronic diseases and progressive changes in the immune system. Inflammation, for exam-

ple, is exaggerated with advancing age—a phenomenon termed "inflamm-aging" that is exacerbated during infection as the result of the release of proinflammatory cytokines in a so-called cytokine storm (Bartleson et al., 2021). In COVID-19, this response is reflected in a dramatic accumulation of inflammation-related fluid in the lungs, impairing lung function and potentially leading to tissue damage, shock, respiratory failure, and death. Beyond this inflammatory response, other components of the immune system, such as the cells that fight off invading organisms directly (T cells) and the release of antibodies (B cells), become less effective in old age (Bartleson et al., 2021).

In addition to changes in the immune system, age-related reductions in organ function, including the lungs, heart, and kidneys, even in the absence of disease, place older persons at excess risk of adverse health outcomes by decreasing their physiologic reserve. Frailty also has contributed to the vulnerability of older persons during COVID-19 and is associated with need for mechanical ventilation, hospital length of stay, and risk of mortality (Labenz et al., 2020; Tehrani et al., 2021). Additionally, the pandemic has led to reductions in functional capacity among older adults in some places, presumably because of lockdowns, in which people were limited in how often and where they leave their homes. For example, average walking speed decreased for older populations in Japan (Obuchi et al., 2021). Although lockdowns were important for minimizing the spread of COVID-19, they reduced opportunities for physical activity among older adults, with direct implications for functional and cognitive capacity.

Clinical and Social Factors

It is common for many diseases, such as pneumonia, to present different symptoms in older adults than in younger populations (Gómez-Belda et al., 2021). Older adults presented symptoms of COVID-19 that were atypical in other populations, including sore throat, delirium, and lower oxygen in the blood (Nanda et al., 2020). At the onset of the pandemic, older patients with such atypical symptoms were often deemed ineligible for testing, leaving their infections undetected and left to worsen without appropriate attention (Rowe, 2020).

Additionally, as discussed above, frail patients with multiple chronic diseases are more likely to die from COVID-19 because of an increased risk of clinical adverse events (Yang et al., 2021). Severe underlying illnesses, such as diabetes, cancer, and heart failure, are aggravated by COVID-19 and lead to more serious illness in older adults (CDC, 2021c). As discussed in Chapter 4, many older adults face inequitable social determinants of health, such as lack of access to nutritious foods and health care, similar to those determinants affecting minority populations (CDC, 2022).

Complicating the enhanced risk of infection and serious illness in older people is the heightened risk of anxiety and depression, with these conditions affecting 30 percent of the global population during the pandemic (Santomauro

et al., 2021). Social isolation has contributed to increased rates of loneliness among older people, who have often been separated from family and friends (WHO, 2021c).

THE PANDEMIC'S IMPACTS ON HEALTH SYSTEMS

While the response of health systems—including public health, health care, and long-term care—has varied dramatically across countries during the pandemic, older people have been the most severely affected segment of the population.

Public Health Systems

In 2019, prior to the pandemic, two comprehensive indices were established for assessing the capacity of countries to respond to an epidemic. These indices— the Global Health Security (GHS) Index and the Epidemic Preparedness Index— though distinct from each other, were both based on traditional measures thought to be reliable reflections of "readiness" (GHS, 2021). Similarly, the World Health Organization (WHO) conducted joint external evaluations to assess countries' abilities to respond to public health risks (WHO, 2021b). Its measures included public health prevention systems, infrastructure, detection and reporting capacity and communications, wealth, general health system capacity, and compliance with international norms. The metrics were calculated for most countries.

Of interest, country-specific scores on the GHS Index were not predictive of access to health care during the pandemic. For instance, the two countries rated highest overall on the indices, the United States and United Kingdom, fared poorly on health care access compared with many other countries that were ranked lower overall (GHS, 2021). The GHS Index report, released in 2021, also points to the need for metrics with a greater emphasis on inequalities; the role of community-based factors and civil society; the effects of globalization; centralized versus fragmented governance; uncoordinated funding; and political factors, especially the importance of political leaders embracing science-based advice (GHS, 2021). The use of metrics that reflect these additional consider-ations would enable public health systems to incorporate them into planning and preparedness efforts ahead of emergencies.

Health Care Systems

The COVID-19 pandemic had dramatic, often crushing, effects on the acute health care system. These effects had disproportionate impacts on older people, who generally use and depend more on the delivery of acute health care services than younger people. Immediate effects in areas with high community trans-mission of COVID-19 included surges of hospitalized patients, many requiring

intensive care and respiratory support that placed a strain on intensive care units (Grimm, 2021). Acute care capacity was often overwhelmed, requiring the establishment of supplemental resources, such as field hospitals (CDC, 2020).

Due to closures and capacity limitations, routine preventive and maintenance outpatient visits, acute care visits, elective surgeries, and hospital admissions for non-COVID-19 conditions surged (Heist et al., 2021). Dramatic increases in the use of telemedicine services ameliorated some gaps in care by enabling people to access health care services in the comfort of their home instead of risking exposure to the virus in health care facilities (CDC, 2021d). Countries that lowered existing barriers to the adoption of virtual care (e.g., by allowing reimbursement for telemedicine appointments) saw large increases in use of these virtual platforms (Weigel et al., 2020). But such visits cannot include the blood tests and other diagnostic and screening measures ancillary to in-person visits, thus requiring visits to a laboratory. Additionally, many older people lack access to or are unable to use the technologies required for telemedicine. Inequities in health care access within and across countries have lasting implications for population health and for those most impacted by barriers to care, including older people (UN, 2020).

The long-term effects of this dramatic disruption in health care services are yet to be determined. There is substantial concern that delays in the detection and treatment of conditions such as cancer will increase morbidity and mortality over the coming years. Additionally, reductions in routine blood tests and other diagnostics that are generally included in office visits but not in telemedicine suggest less rigorous monitoring and control of chronic disorders such as diabetes.

Long-Term Care

The COVID-19 pandemic has disproportionately affected older individuals receiving long-term care, especially those residing in nursing homes. There are 1.5 million nursing home residents in the United States, 83.5 percent of whom are aged 65 and older (Su et al., 2021). According to *The New York Times* database, long-term care facilities in the United States accounted for 31 percent of COVID-19-related deaths nationwide, with other high-income countries having similar experiences (*The New York Times*, 2021). In low- and middle-income countries, the proportion of older adults in long-term care facilities is lower, but several issues, such as limited testing and inability to disaggregate COVID-19 data in long-term care settings, are barriers to conducting analysis of the pandemic's impacts in long-term care facilities.

At the outset of the pandemic, long-term care facilities faced challenges in accessing or procuring personal protective equipment and COVID-19 tests, and infection control training. They found it difficult to reduce congregate care in order to protect both patients and staff while prioritizing well-being to avoid isolation and loneliness (Whitman, 2020). These challenges were exacerbated by the fact that home-based and residential long-term care services share the limited

supply of physicians and nurses with training and expertise in geriatrics (Global Coalition on Aging, 2021).

The pandemic has made clear that, despite the clinical status of many nursing home residents and the numerous challenges facing these facilities, infection, serious illness, and death are not inevitable in this patient population. Data from the National PACE (Program of All-Inclusive Care for the Elderly) Association show that infection rates were much lower for older adults receiving home-based care compared with those in long-term care facilities (PACE, 2021). The data also suggest that providing home-based services, expanding the use of telehealth, using mobile health vans, and providing social supports through engaging activities can reduce infection rates.

In addition to placing greater emphasis on home-based care, it will be important going forward to redesign long-term care facilities to provide more programmatic flexibility and greater protection from contagion during epidemics. Distributing people across rehabilitation centers, hospice, and memory care centers, and ideally smaller long-term care settings, could help to avoid some of the challenges experienced in 2020 and 2021. The adverse experiences of long-term care facilities with COVID-19 will likely have generated increased interest and investment in hospital-based extended care units, home-based care, and other community-based care models.

SOCIAL AND BEHAVIORAL EFFECTS

In addition to the impacts on life expectancy and morbidity resulting directly from COVID-19, the pandemic had negative social and behavioral impacts on older adults in several areas discussed in this report, including ageism, isolation and loneliness, the digital divide, as well as intergenerational impacts. At the same time, research conducted throughout the pandemic has found that older adults are often more resilient than their younger counterparts.

Impacts of Ageism

Pervasive ageism predates the COVID-19 pandemic and has been a critical public health problem for years (see Chapter 4). Ageist attitudes can be seen in government, business, education, health and social institutions, and popular culture. But the pandemic elevated awareness of and revealed ageist attitudes in new and disturbing ways. The early public messaging on the virus incorporated ageist narratives. Media outlets often paired the terms "vulnerable" and "older people" when describing the pandemic (Swift and Chasteen, 2021). In some countries, including China, this messaging intensified the perception among younger generations that older people were a threat to public health (Zhang and Liu, 2021). Although there are signs that the pandemic exacerbated generational divides, there are also cases of younger generations making significant sacrifices

to protect the health of older adults by complying with pandemic restrictions, such as mask wearing and online school and work.

Social media played a role in elevating ageist narratives about aging and older adults during the pandemic. Some messaging about COVID-19 characterized older adults as helpless and expendable, as represented by references to "#BoomerRemover" on Twitter. The response to the pandemic was influenced by the negative stereotype that older adults are dependent, frail, and sickly, and the pandemic fed that stereotype. An analysis of activity on Twitter suggested that large numbers of tweets posted during the onset of the pandemic could be considered ageist because they implied that the lives of older adults were less valuable than those of younger people (Malik et al., 2020).

Ageist expectations have impacted health care policy and practice during the pandemic. During the pandemic, calls for rationing care and sacrificing older adults for the greater good were reported (Sonmez, 2020). Reports from Italy suggested that, because of strain on hospital resources, policies were in place to care for those—often younger patients—who stood to benefit most and had the greatest chance of surviving (Rosenbaum, 2020). This commission understands that some rationing of care may be unavoidable in the midst of a global pandemic, but determinations should be based on medical judgments on a patient-by-patient basis, not on top-down mandates. Chronological age alone should never be a barrier to care.

The impacts of ageism during the pandemic have extended beyond health. As discussed below, job losses and forced retirements, particularly for the most vulnerable older adults, increased during the pandemic. Reports of elder abuse, including family violence, neglect, and financial exploitation, increased in the United States (Chang and Levy, 2021). Additionally, because of social isolation, opportunities for elder abuse to be detected by caregivers and others were reduced (Makaroun et al., 2020). However, community-level responses across the globe have shown solidarity in supporting the physical and mental well-being of older adults. For example, community health workers in Rwanda are monitoring the health and social conditions of older adults in communities while giving them vital information about the pandemic and providing much-needed social interactions (Louis et al., 2022). In another example, Chile launched the Major Protection plan to reinforce care for adults over age 80 who must remain at home during lockdowns (UN, 2020).

The stereotype embodiment theory holds that "negative age stereotypes can be internalized by people of all ages and when these views become self-relevant, influencing older persons' beliefs about their own aging, they can detrimentally impact health" (Ayalon et al., 2021, p. e49). While segregating and quarantining older people to protect them from the virus may have been a necessary public health measure, that distancing elevated ageist stereotyping. The health consequences of the portrayal during the pandemic of older adults as vulnerable and weak and younger adults as healthy and less susceptible—and the influence of

that portrayal on older adults' attitudes about their own aging—will be understood only with future study (Swift and Chasteen, 2021).

The United Nations (UN) and WHO are focused on combating ageism through a global strategy and action plan on aging and health. The Decade of Healthy Ageing, along with the related work of member states, agencies, and civil society organizations, is aimed at combating ageism and improving health, increasing opportunity, reducing costs, and enabling flourishing at any age (WHO, 2021a).

Impacts of Isolation, Loneliness, and the Digital Divide

Social isolation and loneliness increased during the pandemic as older adults sheltered in place. The distancing that was a critical safety measure for vulnerable individuals separated them from friends and coworkers; children and grandchildren; and a range of traditional support networks, such as senior centers and faith institutions. The United Nations suggests that the psychosocial and mental health needs of older people were less likely to be met during lockdowns because of the breakdown of social networks (UN, 2020).

The lack of human contact during the pandemic has been especially difficult, but social isolation (defined as a lack of meaningful connection with others) has been an underappreciated public health challenge for older people for many years. A University of Michigan study found that more than half of older adults in the United States reported "feeling isolated from others," and about half of adults aged 50–80 felt "more isolated" since the start of the pandemic (Piette et al., 2020, p. 1).

Technology served as a bridge for many people during the pandemic. As previously discussed, telemedicine allowed people to receive basic levels of care while not risking exposure to the virus. Digital technology allowed people to connect with loved ones virtually and helped reduce feelings of social isolation and loneliness. However, the benefits of these virtual connections were not shared equitably. Barriers to using technology—negative attitudes toward internet usage, limited access to broadband, and lack of digital literacy—created corresponding barriers to accessing critical information and communication about COVID-19 (UN, 2020). Older people have disproportionately limited access to and usage of internet technologies, and this is especially true for older people in lower-income countries (UN, 2020). Thus, it is important to assess the needs of older people who are isolated and determine safe ways to provide them with accessible social support. Additionally, information sources, such as print notifications, that provide critical information about COVID-19 can be personalized to reach older community members who may not have access to technology. Efforts to improve digital literacy skills, as discussed in Chapter 4, would also help mitigate the isolation and loneliness felt by those who lack familiarity with online social platforms.

Intergenerational Impacts

The health and social benefits of intergenerational connections have been confirmed by research over many years. Teaching and mentoring programs, co-housing arrangements, social networks, and other programs have demonstrated value for both younger and older people (see Chapter 4). Yet, despite widespread efforts to foster intergenerational comity and collaboration, the stresses of the pandemic have impeded and tested intergenerational relations in dramatic ways.

At the societal level, public health mandates, social isolation, economic stresses, and other factors associated with the pandemic appear to have increased generational divides. According to research sponsored by AARP, the economic effects of the pandemic have forced families to merge households for financial survival (Binette and Vasold, 2018). But despite its many benefits, intergenerational living also resulted in increased risk of contracting COVID-19 for older adults as younger people brought SARS-CoV-2 home from school or work.

The global nature of the pandemic and the future risks it has highlighted have led some to call for a reimagining of intergenerational health. The commission advocates for an approach not just focused on the health of individuals and families but also recognizing that health exists at the intersection of the environment and society and cannot be approached from a purely biomedical perspective.

ECONOMIC IMPACTS

The economic impacts of the pandemic have varied significantly, reflecting wide disparities across societies. Older adults have been not only at higher risk of serious illness if they contract COVID-19 but also financially vulnerable if the pandemic has led to a sustained drop in their income and retirement savings (Koma et al., 2020). Studies suggest, for example, that more than one-third of U.S. adults aged 65 or older live in counties that rank in the top percentages of both COVID-19 prevalence and the highest costs of living (Li and Mutchler, 2020).

A recent study completed in Mexico found that low-income patients who tested positive for COVID-19 were four times more likely to require hospitalization than higher-income patients (Arceo-Gomez et al., 2022). Additionally, research conducted by the United Nations suggests that the risk of poverty increases with age, and more than 80 percent of the aging population lives in poverty in some lower- to middle-income countries (UN, 2020). Therefore, older adults faced the negative implications of the correlation between low income levels and hospitalizations during the pandemic.

Older adults in general suffer declines in wealth during such economic downturns as that experienced in 2020, and they have less time than younger adults to make up such losses to secure their retirement. Older adults in minority populations are especially likely to experience significant declines in financial

well-being in times of economic stress, exacerbating economic disparities that have existed during most of their working years (Li and Mutchler, 2020). The economic downturn resulting from the pandemic has greatly impacted older women in lower- to middle-income countries in particular because of their limited access to income and pension programs (UN, 2020).

Finally, in the United States, about 11 percent of those aged 65 and older—approximately 1.1 million people—have lost their jobs during the pandemic, threatening their financial security at a time of life when economic recovery may be unlikely (Jacobson et al., 2020). According to a Pew Research Center study (Horowitz et al., 2021), more than one-quarter of U.S. adults aged 50 and older believe the pandemic will affect their ability to retire and achieve their financial goals.

LESSONS LEARNED

While much has been learned during the pandemic regarding effective approaches for protecting older persons and the general public going forward, five general areas emerge as especially important.

Geroscience

The disproportionate adverse effects of advancing age on the risk of COVID-19, even in the absence of significant preclinical morbidity, have clearly underlined the rudimentary state of understanding of the aging-related physiological changes that bring greater susceptibility to infection, severe illness, and death. Given the dramatic increases globally in the number and proportion of older persons, much greater investment in basic and clinical research is essential to better understand the pathophysiology of diseases and develop effective therapeutics.

Readiness Assessments

The need to revise current risk assessment strategies is clear from the fact that internationally recognized indices, such as the GHS Index, that were designed to indicate the levels of countries' preparedness for an epidemic failed to accurately predict the pandemic's toll on individual countries. Revised approaches could rely less heavily on issues of biosafety and include more consideration of the effects of globalization, especially differences between high- and low- or middle-income countries; community-based and civil society–related issues; ability to establish effective supply systems; the prevalence of digital-access skills, particularly in older and underprivileged groups; and political risks. In addition, given the disproportionate risks for certain subsets of the population, such as older persons with COVID-19 and children with malaria or other infections,

future indices need to assess readiness with respect to defined subpopulations in addition to countrywide metrics.

Intersectoral Collaboration

One major lesson of the COVID-19 pandemic has been the need for significant collaboration between the public and private sectors and among various disciplines within the public sector. During the pandemic, sharing of expertise, data, and resources within both the public and private sectors, as well as across sectors, was unparalleled and yielded some extraordinary outcomes. For example, intense collaboration among academic and government institutions and pharmaceutical firms yielded the rapid development, mass production, and distribution of personal protective equipment, vaccines and syringes, coronavirus test kits, and therapeutics. An essential, and often overlooked, aspect of preparedness is pre-epidemic establishment of effective mechanisms to facilitate rapid and intensive collaboration, including sharing of best science, expertise, and resources, within and between the public and private sectors, as well as enhanced communication and collaboration between local and state regulators.

Data and Analytics

While data and analytics clearly inform readiness assessments, data sharing and use of real-time data have been shown to be critical for effective decision making about health care during the pandemic. These tools have been key to effective intersectoral collaboration and the rapid advances made in artificial intelligence, machine learning, and predictive modeling. The capacity to identify important underlying actionable trends in large datasets warrants special attention to these issues. Data sharing is an essential component of effective and productive collaboration across and within sectors to ensure that the most cutting-edge approaches are being applied to interrogation of the most up-to-date and valid data.

Rebalancing and Redesigning Health Care Systems

It has long been clear that many countries have overinvested in acute care, fueled in part by demographic trends, lack of regulatory controls, and new technologies, to the disadvantage of public health and long-term care (see Chapter 6). Countries around the world need to rebalance and redesign their health care systems. It will be important for these efforts to include assessment of public health system infrastructures, which are often badly in need of major investments to enhance preparedness to protect the population, especially older people. And as discussed above, long-term care systems, including nursing homes, home-based care, and community-based elements of care, need to be redesigned with greater flexibility and capacity to protect and serve older people, particularly during epidemics.

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Appendix C

Regional and Economic Interviews

REGIONAL INTERVIEWS SUMMARY

The commission invited experts from across the globe to respond to a questionnaire to garner a broader range of regional perspectives of healthy longevity. Topics included roles of older adults in the family, ageism, intergenerational cohesion, engagement in the workforce, and government efforts to improve healthy longevity. In August–September 2021, a total of 15 experts responded to the questionnaire (12 individual interviews were conducted by staff, 3 experts submitted written responses). A summary of the responses was shared with the commission to inform its deliberations.

Questionnaire

1. How do people in your country generally perceive:
   a. Older adults' contributions to family, community, and society, including paid work, unpaid caregiving (e.g., for older adults, family members with disabilities, children), and/or volunteering?
   b. The prevalence and impacts of ageism?
   c. The degree of intergenerational cohesion?
2. Describe the engagement of older adults in the workforce:
   a. Do older people want to stay in the paid workforce longer than they are able? If yes, what are the barriers to staying in the paid workforce?
3. Are there current efforts under way to improve healthy longevity in your country?

253

4. How open are government officials or policymakers to prioritizing healthy longevity in your country?

Experts Responding to the Questionnaire

Tareef Al-Aama, Ministry of Health, Saudi Arabia

Heung Bong Cha, International Association of Gerontology and Geriatrics, South Korea

Angelique Chan, Duke–National University of Singapore, Singapore

AB Dey, Institute of Medical Sciences, India

Aisen Etcheverry, Chilean National Agency for Research and Development, Chile

Roseline Kihumba, HelpAge, Kenya

Naoki Kondo, Kyoto University, Japan

Rintaro Mori, United Nations Population Fund, Thailand

Hiromasa Okayasu, World Health Organization, Japan

Pip O'Keefe, University of New South Wales, Australia

Franklin Quijano, National Commission of Senior Citizens, Philippines

Neena Raina, World Health Organization, India

Luis Miguel Gutiérrez Robledo, National Institute of Geriatrics, Mexico

Abla Mehio Sibai, American University of Beirut, Lebanon

Findings

- Older adults are valued and respected by family and community members.
- Older adults' workforce participation varies across regions; however, all experts agreed with the notion that lower-income adults tend to remain in the workforce past retirement age out of necessity, while higher-income adults are likely to continue to work voluntarily, unless companies have age-based forced-retirement policies, which are often not based on physical/mental capabilities and stem from ageist thoughts and beliefs.
- By promoting intergenerational cohesion through workplace cohorts and educational campaigns in communities, older and younger adults can break down ageist thoughts and beliefs.
- Across regions, older adults who retire often remain active in their communities through formal and informal roles, which helps to combat isolation and loneliness. Frequently, grandparents become the caregivers for grandchildren, a trend influenced by an increase in female workforce participation and by generation gaps in Africa caused by HIV/AIDS.
- Lower- to middle-income countries advocate for family caregiving and community-based supports rather than institutional care, as many older adults do not have access to adequate care facilities or pension programs to help cover the costs of care.

- Additionally, all experts agreed that it is important for governments to invest in and address social determinants across the life course. Domains identified include public education campaigns that promote access to nutritious foods, clean air, adequate education, and opportunities to be physically active.

ECONOMIC INTERVIEWS SUMMARY

The commissioners identified economic experts whose research focuses on areas not already represented by members of the commission in order to broaden the set of perspectives on how economics influence opportunities to improve healthy longevity, and how healthy longevity impacts economic policies. Each expert received a questionnaire exploring various economic aspects of healthy longevity: workplace policies, pensions, and retraining and education. In September 2021, a total of six experts responded to the questionnaire (five written submissions, one interview with staff). A summary of the responses was shared with the commission to inform its deliberations.

Questionnaire

1. How best can the economy support healthy longevity?
   a. What do you think would be the most valuable social gains arising if more people had robust health, function, and well-being in the second half of life?
   b. What financial measures can be taken to support healthy longevity?
2. How can healthy longevity support the economy?
   a. What additional or new economic benefits would be predicted if more people had robust health, function, and well-being in the second half of life?
3. What levels of support should governments give people in older age (e.g., long term care, retirement income)? What economic and financial policies would ensure that supports are sustainable and broadly available? How would this differ between low- and middle-income countries compared to high-income countries?
4. What are the most important policy recommendations you would make for your country to support healthy longevity?

Experts Responding to the Questionnaire

David Cutler, Harvard University, United States
Eric French, University of Cambridge, United Kingdom
Ralph Koijen, University of Chicago, United States
Moshe A. Milevsky, York University, Canada
James Poterba, Massachusetts Institute of Technology, United States

Stijn Van Nieuwerburgh, Columbia Business School, United States
Julie Zissimopolous, University of Southern California, United States

Findings

- Boosting healthy longevity is good for the economy because older adults gain additional years of healthy living and rely less on pensions and social security.
- Healthy longevity is good for the well-being of older adults. Avoiding the adverse effects of morbidity and mortality, spending more time with family, and making social gains may be the most important benefits, but they are also the most difficult to measure in economic terms.
- Benefits of healthy longevity on economies include labor supply, decreased care and productivity costs, financial security, and increased gross domestic product if older adults stay in the workforce longer.
- Interventions that improve healthy longevity across the life course include public and private investments in early-childhood education, coupled with job retraining, reliable insurance, medical care, and workplace policies that promote health and well-being.
- A well-functioning market for long-term care and for long-term care insurance is vital to ensuring the well-being of the elderly. Experts suggest that this can be achieved through private, long-term care insurance markets in which companies compete on price and quality of insurance plans, and effectively reduce the burden on governments.
- The cost of providing health insurance for older workers may exceed the marginal revenue generated by employing them. If U.S. Medicare programs became the primary health insurance provider for adults aged 65 and older regardless of work status, the employer would not take on the burden of insurance costs and the demand for workers would likely rise.

Appendix D

Public Workshop Agendas

The commission held three workshops to gather information and convene global actors, and benefited substantially from expertise shared at each. The first, Social, Behavioral, and Environmental Enablers for Healthy Longevity, was held in Washington, DC, and hosted by AARP. The second, Health Care and Public Health Systems for Healthy Longevity, was held in Singapore and hosted by the National University Health System, Singapore. The final, Science and Technology for Healthy Longevity, was held virtually because of the COVID-19 pandemic.

WORKSHOP 1 AGENDA

Social, Behavioral, and Environmental Enablers for Healthy Longevity: A Workshop for the Global Roadmap for Healthy Longevity Initiative

AARP
601 E Street, NW
Washington, DC

November 6–8, 2019

Objectives

This 3-day public workshop will examine the social, behavioral, and environmental enablers for healthy longevity. Workshop participants will discuss

257

the challenges and opportunities, as well as potential solutions and disruptive approaches to enhance social structures and living environments that would enable healthier and socially fulfilled lives and ultimately create thriving societies around the world.

Specifically, this workshop will feature invited presentations and discussions on topics including

- theoretical foundations and key concepts and definitions for equitable healthy longevity;
- existing evidence on the social, behavioral, and environmental enablers of healthy longevity, including determinants, pathways, and policy entry points;
- critical challenges and gaps in current approaches for creating social and environmental structures that promote healthy behaviors across the life course and enable aging populations to lead meaningful and productive lives;
- key successes of policies and programs in targeting the social, behavioral, and environmental determinants of health related to healthy longevity;
- opportunities, approaches, and potential priorities—including the consideration of data, indicators, and measures that should be collected—for designing and applying social, behavioral, and environmental enablers to guide effective multisectoral solutions and actions that foster integrative care without medicalizing these solutions; and
- effective mechanisms for stimulating meaningful collaboration among various relevant stakeholders across sectors and disciplines.

Day 1 – Wednesday, November 6

1:00pm   **Welcome remarks**
          JO ANN JENKINS, Chief Executive Officer, AARP

          An overview of the Global Roadmap for Healthy Longevity Initiative
          VICTOR DZAU, President, National Academy of Medicine

          Workshop overview and goals
          JENNIE POPAY, Distinguished Professor of Sociology and Public Health, Lancaster University

Keynote Address:
A conceptual framework for understanding the social,
behavioral, and environmental enablers for healthy longevity
from a health equity lens
SIR MICHAEL MARMOT, Director, Institute of Health Equity

Q&A Discussion

SESSION 1 — Foundations for Healthy Longevity: Understanding the
Contributions and Linkages of Social, Behavioral, and Environmental
Enablers

2:20pm   Session 1 Objectives:
- Discuss the meaning of "healthy longevity"
- Highlight how to measure healthy longevity and the underlying reasons for global- and country-level trends and disparities in healthy longevity
- Understand the contributions and interactions of social, behavioral, and environmental enablers upon healthy longevity

Plenary Presentation:
What is "healthy longevity"? Understanding the multifaceted
challenges and opportunities from a life course perspective
LISA BERKMAN, Director, Harvard Center for Population and Development Studies

Panel Presentations:
The factors underlying current and future trends of healthy
longevity
ALI MOKDAD, Chief Strategy Officer of Population Health, University of Washington

Understanding the linkages of social, behavioral, and
environmental determinants across diverse populations,
lifestyles, and contexts
ASGHAR ZAIDI, Professor of Gerontology, Seoul National University

3:00pm   **Q&A Discussion**

3:30pm   **Break**

3:45pm   **Examining the economics of healthy longevity**
          BRENDA GANNON, Professor, School of Economics, University
          of Queensland

          **How inequality shapes later life: Lessons from the everyday
          experiences of aging people**
          COREY ABRAMSON, Associate Professor of Sociology, University
          of Arizona

4:15pm   **Q&A Discussion and Moderator Synthesis of Session 1**
          Moderator: BRIDGET KELLY

4:50pm   **Table Group Discussion:**
          **This discussion will be an interactive session that will allow
          participants to share their knowledge, expertise, and personal
          experiences about healthy longevity in small groups.**

5:20pm   **Report Back and Audience-Wide Discussion**
          **Audience members will report back on their small group
          discussions and engage in a general discussion.**

5:50pm   **Observations from Day 1**
          MOSA MOSHABELA, Dean and Head, School of Nursing and
          Public Health, University of KwaZulu-Natal

6:00pm   **Adjourn**

6:15pm   **Official Launch of the Global Roadmap for Healthy Longevity
          Initiative**

6:45pm   **Reception**

                    Day 2 – Thursday, November 7

8:30am   **Welcome and Recap Day 1**
          JENNIE POPAY, Distinguished Professor of Sociology and Public
          Health, Lancaster University

**SESSION 2 — Age-Friendly Environments: Overcoming Challenges and
Harnessing Best Practices**

8:40am   Session 2 Objectives:
          •   Understand lessons learned and best practices for different
                programs that have aimed to create age-friendly environments
                in various contexts

- Examine cross-cutting challenges that need to be overcome across different programs
- Discuss how to bolster evidence and evaluate age-friendly environments that could inform other contexts

Opening Presentation:
Designing safe, smart, and sustainable built environments across diverse contexts to support healthy longevity
CHINMOY SARKAR, Assistant Professor of Geographic Information Systems, Urban Health and Environment, The University of Hong Kong

Case Studies:
Age-friendly environments in the UK and Europe: Improving the quality of life for aging populations
PAUL MCGARRY, Head, Greater Manchester Ageing Hub

Redesigning communities to transform aged societies: A model from Kashiwa, Japan
HIROKO AKIYAMA, Professor, Institute of Gerontology, University of Tokyo

Building a city focused on healthy longevity and well-being: Learning from Kigali, Rwanda
NADINE UMUTONI GATSINZI, Vice Mayor in Charge of Socio-Economic Affairs, City of Kigali, Rwanda

Q&A Discussion and Moderator Synthesis of Session 2

10:30am   **Break**

SESSION 3 — Reimagining the Social World Across the Life Course

10:45am   Session 3 Objectives:
- Reexamine the social world for aging populations where they can actively contribute and thrive in societies
- Assess approaches that leverage effective social care and services that avoid the overmedicalization of aging
- Evaluate how social actions and reforms potentially address health inequalities across populations

Moderator: LAURA CARSTENSEN, Stanford University, United States

Panel Presentations:
Lifelong learning opportunities and engagement of aging populations
OMOBOLANLE AMAIKE, Associate Professor of Sociology, University of Lagos

Harnessing social networks and intergenerational support to empower active lifestyles across the life course
QUYEN TRAN, Regional Programme Advisor, Asia and Pacific Regional Office, HelpAge International

Cultivating environments that promote work, volunteering, and reciprocity
NANCY MORROW-HOWELL, Distinguished Professor of Social Policy, Washington University in St. Louis

Q&A Discussion and Moderator Synthesis of Session 3

12:00pm **Lunch**

SESSION 4 — Uncovering the Unknowns and Extricating Uncertainties to Push the Field Forward

1:00pm Session 4 Objectives:
- Elucidate the uncertainties and challenges related to healthy longevity to help advance scientific and policy agendas
- Identify the roles and contributions of various stakeholders required to overcome the challenges
- Explore foundational principles and potential solutions for extricating challenges across a variety of contexts

Moderator: PAUL IRVING, Milken Institute Center for the Future of Aging

Panel Discussion:
Growing challenges of labor market dynamics and financial decisions for aging people and their families: Perspectives from Asia and Eastern Europe
ELENA GLINSKAYA, Lead Social Protection Specialist, World Bank

Retirement income design with an aging demographic
JOHN PIGGOTT, Professor of Economics and Director, ARC
Centre of Excellence in Population Ageing Research

**The pathways and implications of ageism: Is it possible to
eliminate ageism?**
LIAT AYALON, Professor and Deputy Director, School of Social
Work, Bar-Ilan University

**The diverse nature of aging populations: Uncovering
intersectionality and the historical, cultural, and contemporary
contexts that shape health**
LAIA BÉCARES, Co-Director, Centre for Innovation and
Research in Wellbeing

Q&A Discussion and Moderator Synthesis of Session 4
Moderator: BRIDGET KELLY

3:00pm   **Break**

3:15pm   **World Café Breakout Group Discussion**
           Group 1: Working life and retirement (*Group Moderator:* JOHN
           PIGGOTT)
           Group 2: Ageism (*Group Moderators:* ERWIN TAN and ROGER
           CHUNG)
           Group 3: Equity, diversity, and intersectionality (*Group
           Moderator:* JOAN ZLOTNIK)

4:30pm   **Audience-Wide Discussion:**
           **Audience members will report back on their breakout groups
           and engage in a general discussion.**

5:20pm   **Observations from Day 2**
           PAUL IRVING, Chairman, Milken Institute Center for the Future
           of Aging

5:30pm   **Adjourn**

Day 3 – Friday, November 8

8:30am   **Welcome and Recap Day 2**
           JENNIE POPAY, Distinguished Professor of Sociology and Public
           Health, Lancaster University

SESSION 5 — Translating Knowledge into Policy and Practice

8:40am   Session 5 Objectives:
- Develop a disruptive vision of environments that will create healthy longevity
- Explore barriers and opportunities for translating knowledge on healthy longevity into policy and practice
- Consider societal opportunities resulting from healthy longevity
- Examine strategies to engage political leadership and build the business case to invest in policies and actions promoting healthy longevity
- Highlight models of innovative collaboration, partnership, and coalitions across various contexts
- Understand approaches to genuinely engaging with older adults from the research process through implementation and evaluation to ensure sustainable and effective solutions

Moderator: PAULIN BASINGA, Co-Chair of the Workshop, Bill & Melinda Gates Foundation, Nigeria

Moderated Panel Discussion
ANNA DIXON, Chief Executive, Centre for Ageing Better
MALA KAPUR SHANKARDASS, Asia Representative, International Network for the Prevention of Elder Abuse
ANGELIQUE CHAN, Executive Director, Centre for Ageing Research & Education, Singapore
ENRIQUE VEGA, Unit Chief, Healthy Life Course Unit, Pan American Health Organization
DEBRA WHITMAN, Chief Public Policy Officer, AARP

General Discussion and Moderator Synthesis of Session 5

10:15am   **Break**

SESSION 6 — Reflecting on Top Priorities for Research, Policy, and Practice

10:30am   Session 6 Objectives:
- Synthesize long-term vision, goals, and priorities for impact, collaboration, and synergy with global health initiatives such as Universal Health Coverage and the Sustainable Development Goals

- Explore opportunities for developing new approaches to research, policy, and practice to enhance healthy longevity from the local to global levels
- Discuss strategies to leverage cross-sectoral partnerships among various stakeholders from research to practice

Moderator: LINDA FRIED, Columbia University

Panel Presentations and Discussion
XIAOYING ZHENG, Dean, APEC Health Science Academy, and Director, Institute of Population Research, Peking University
SOMNATH CHATTERJI, Team Lead, Surveys, Measurement, and Analysis Programme, World Health Organization, Switzerland
SIR GEORGE ALLEYNE, Director Emeritus, Pan American Health Organization
MOSA MOSHABELA, Dean and Head, School of Nursing and Public Health, University of KwaZulu-Natal

11:30am   **Q&A and Final Synthesis Discussion**

Closing Remarks
PAULIN BASINGA, Country Director of Nigeria, Bill & Melinda Gates Foundation
JENNIE POPAY, Distinguished Professor of Sociology and Public Health, Lancaster University

12:30pm   **Adjourn**

WORKSHOP 2

**Health Care and Public Health Systems for Healthy Longevity:
A Workshop for the Global Roadmap for Healthy Longevity Initiative**

**National University Health System Tower Block
1E Kent Ridge Rd
Singapore**

February 3–4, 2020

Objectives
    This 2-day public workshop will examine potential approaches and reforms across the entire spectrum of norms, institutions, and systems that provide health- and social-related services to address the multidimensional needs of older populations. Workshop participants will discuss the challenges and opportunities, as

well as potential solutions, that would enhance the design of health and long-term care systems, including clinical services, health promotion, disease prevention services, and social care to foster the capacity and ability of aging societies around the world.

Specifically, this workshop will feature invited presentations and discussions on topics including the following:

- Existing evidence on the strengths and weaknesses of the entire spectrum of norms, institutions, and systems providing health care, health promotion, and preventive services for aging populations, including clinical care provided in primary, secondary, and tertiary settings, self-care, community-based services, and social care and support. These discussions will also identify the potential for innovative new approaches in these areas.
- Critical challenges and gaps in current approaches for ensuring an appropriately skilled and sustainable workforce, including informal caregivers, to address the needs of older adults.
- Key successes and failures of policies and programs targeting access to and quality of health care, health promotion, and preventive services across the life course that affect healthy longevity.
- Health financing and policy tools to guide effective multisectoral solutions and actions to reform service delivery, public health systems, and community capacity in ways that will have a positive impact on aging.
- The potential for new data approaches, health information tools, and innovations to transform health systems and health promotion and prevention services.
- Effective mechanisms for stimulating meaningful collaboration among relevant stakeholders across sectors and disciplines.

Workshop speakers and discussants will contribute perspectives from government, academia, private, civil society, and nonprofit sectors from the local to global levels.

Day 1 – Monday, February 3

8:30am   **Welcome remarks**
              JOHN EU-LI WONG, Senior Vice President (Health Innovation &
              Translation), National University of Singapore

Opening remarks
AMY KHOR, Senior Minister of State, Ministry of Environment and Water Resources & Ministry of Health

An overview of the Global Roadmap for Healthy Longevity Initiative
VICTOR DZAU, President, National Academy of Medicine

Workshop overview, goals, and framework
JOHN BEARD, ARC Centre for Excellence in Population Ageing Research, University of New South Wales
SHARON INOUYE, Director, Aging Brain Center

9:10am   **Keynote Address**
FINBARR MARTIN, President, European Geriatric Medicine Society

            Q&A Discussion

10:00am   **Break**

SESSION 1 — A Future-Back Vision of Health Care and Public Health Systems to Achieve Healthy Longevity

10:15am   Session 1 Objectives:
- Examine the possibilities of realigning systems to provide accessible, integrated, and personalized care across the life course in various contexts
- Highlight opportunities in leadership, governance, and collaboration to disrupt the status quo and mobilize societal transformations toward a healthy longevity future

Moderator: LINDA FRIED, Columbia University

Presentations:
Global trends of health and longevity across generations: Discussing the experiences of past and present generations and projecting the future characteristics of aging cohorts
S. JAY OLSHANSKY, Professor, University of Illinois Chicago

Economics of health and aging in diverse societies and developmental contexts (balancing priorities to finance health and other actions for healthy longevity)

DAVID CANNING, Professor of Population Sciences, Harvard University
Community-based approaches to longer, healthy lives
CHARLENE CHANG, Group Director (Aging Planning Office), Ministry of Health

11:15am   **Q&A Discussion**

12:00pm   **Lunch**

SESSION 2 — Maintaining the Robust Health of Aging People

1:00pm   Session 2 Objectives:
- Assess innovative strategies and interventions that promote health and prevent disease in various settings, including the homes, workplace, and built environments, to encourage well-being and enhance the quality of life
- Highlight salient enablers such as social cohesion, education, and workforce participation that promote healthy longevity across the life course
- Examine approaches that ensure care providers have adequate training and tools to deliver and monitor health-promoting and preventive services for aging individuals that empower them to live in healthy, dignified, and meaningful ways
- Understand the role and responsibilities of different stakeholders in investing and financing health promotion and prevention services at the community to national levels

Session Lead: MOSA MOSHABELA
Moderator: ALLISON SQUIRES

Panel Discussion
ALEX EZEH, Dornsife Professor of Global Health, Drexel University
URSULA STAUDINGER, Professor of Sociomedical Sciences, Columbia University
ALANA OFFICER, Senior Health Adviser, World Health Organization

1:45pm   **Q&A Discussion**

2:45pm   **Break**

SESSION 3 — Supporting the Individual Needs of People with Declining Capacity

3:00pm   Session 3 Objectives:
- Consider contemporary challenges for quality health care service delivery, including enabling patient preferences, horizontal and vertical integration, workforce shortages, affordability, and accessibility
- Highlight innovative health care models (including population based models) empowering transformative change from individual to community and system levels
- Examine quality health care approaches that recognize person's autonomy and comprehensively measure health status and patient reported outcomes; maintain and improve individual capacity, and slow declines in health
- Assess and enhance the quality of health care with the prevention of iatrogenic complications

Session Lead: ISLENE ARAUJO DE CARVALHO
Moderator: ENG-KIONG YEOH

Panel Discussion:
LEOCADIO RODRIGUEZ MAÑAS, Head, Service of Geriatrics, Hospital Universitario de Getafe
MAGGIE KEEBLE, Clinical Lead, ICOPE Worcestershire, United Kingdom
EKACHAI PIENSRIWATCHARA, Director, Bureau of Health Promotion, Department of Health
DAVID LINDEMAN, Director of Health, Center for Information Technology Research in the Interest of Society

3:45pm   **Q&A Discussion**

4:45pm   **Concluding Discussions**

Observations and Reflections from Day 1
PAULIN BASINGA, Country Director, Bill & Melinda Gates Foundation

Final Q&A

5:30pm   **Adjourn**

Day 2 – Tuesday, February 4

8:30am   **Welcome and Recap Day 1**
            SHARON INOUYE, Director, Aging Brain Center
            JOHN BEARD, ARC Centre for Excellence in Population
            Ageing Research, University of New South Wales

SESSION 4 — Expanding Personalized Care for People with Significant Capacity Loss

8:45am   Session 4 Objectives:
            •   Explore challenges and opportunities to integrate long-term
                 care and social care from the community to national levels
            •   Elucidate critical transformations required to establish,
                 implement, and finance integrated care, including societal
                 norms and social status, skills gaps and shortages, and
                 compensation
            •   Emphasize the critical rights of care recipients and providers
                 in maintaining and improving their health and well-being,
                 autonomy, and dignity
            •   Identify disruptive technologies and social innovations to
                 empower intergenerational solidarity and social inclusion
                 throughout individual health trajectories
            Session Lead: EDUARDO KLIEN, HelpAge International
            Moderator: BENT GREVE, Roskilde University

            Panel Discussion:
            FINBARR MARTIN, President, European Geriatric Medicine
            Society
            ANNE MARGRIET POT, Strategic Advisor, Care for Older
            People, Ministry of Health, Welfare and Sport
            ADELINA COMAS-HERRERA, Assistant Professorial
            Research Fellow, Care Policy and Evaluation Centre
            THUY BICH TRAN, Country Director, HelpAge International

9:30am   **Q&A Discussion**

10:25am   **Break**

SESSION 5 — Translating Knowledge into Policy and Practice

10:40am   Session 5 Objectives:
- Explore system-wide barriers and opportunities for translating knowledge on healthy longevity into policy and practice
- Consider societal and economic opportunities resulting from healthy longevity
- Examine strategies to engage political leadership and build the business case to invest in research and development, that lead to policies and actions promoting healthy longevity
- Highlight models of innovative collaboration, partnership, and coalitions across various contexts and sectors to increase translation of research in healthy aging into policies
- Understand approaches to genuinely engaging with older adults from the research process through implementation and evaluation to ensure sustainable and effective solutions

Session Lead: KENJI SHIBUYA, King's College London
Moderator: JEANETTE VEGA, Red de Salud UC-Christus

Panel Discussion:
ROBERT GREENWOOD, Senior Vice President of Public Affairs, National PACE Association
TINA WOODS, Chief Executive Officer and Co-Founder, Longevity International
KAZUMI NISHIKAWA, Director, Healthcare Industries Division, Ministry of Economy, Trade, and Industry
K. SRINATH REDDY, President, Public Health Foundation

11:25am   **Q&A Discussion**

12:20pm   **Lunch**

PRE-SESSION 6 — Recapping Workshop Discussions

1:20pm   Pre-Session 6 Objectives:
- Present and review highlights from the preceding workshop sessions and discussions
- Discuss topics, themes, and issues essential to forming a system for achieving healthy longevity with equity at its center for all people

- Identify and discuss gaps in knowledge and perspectives to solidify the knowledge base of the Global Roadmap for Healthy Longevity initiative and report

Moderator: BRIDGET KELLY
Session I: LINDA FRIED
Session II: MOSA MOSHABELA and ALLISON SQUIRES
Session III: ISLENE ARAUJO DE CARVALHO and EK YEOH
Session IV: EDUARDO KLIEN and BENT GREVE
Session V: KENJI SHIBUYA and JEANETTE VEGA

2:00pm **Q&A Discussion**

2:30pm **Break**

SESSION 6 — Envisioning a System of Health and Well-Being for All

2:45pm Session 6 Objectives:
- Use the lens of four diverse global perspectives to kick off a discussion of how to design ideal future systems that will enhance healthy longevity
- Build on the preceding sessions to identify where ideas for a future vision have converged from the workshop and where there remain uncertainties and differences in perspectives or priorities
- Catalyze a discussion of how the creation of such a future system for healthy longevity can be driven by:
  - synergy with global health initiatives, such as Universal Health Coverage, the Decade for Healthy Ageing, and the Sustainable Development Goals
  - integration among knowledge, policies, and actions opportunities for developing new approaches to research, policy, and practice from the local to global levels
  - strategies to leverage cross-sectoral partnerships and evidence among various stakeholders from research to practice
- Identify likely key challenges or barriers and elicit suggestions for priority steps to be taken in the near, medium, and long term

Session Lead and Moderator: JOHN BEARD

Panel Discussion:
LUIS MIGUEL GUTIÉRREZ ROBLEDO, Director General, Instituto Nacional de Geriatria

> HELEN SCHNEIDER, Professor, University of the Western Cape
> SOONMAN KWON, Professor and Former Dean, School of Public Health, Seoul National University
> WAI CHONG NG, Chief of Clinical Affairs, Tsao Foundation, Singapore

3:50pm **Q&A and Final Synthesis Discussion**

4:40pm **Closing Remarks**
SHARON INOUYE, Director, Aging Brain Center

5:00pm **Adjourn**

WORKSHOP 3

**Science and Technology for Healthy Longevity:
A Workshop for the Global Roadmap for Healthy Longevity Initiative**

Virtual – June 15 and 17, 2021

Objectives

This 2-day public workshop will explore science and technology research and development for enabling healthy longevity. Workshop participants will explore and suggest avenues for innovative and groundbreaking research and development across basic, clinical, pharmaceutical, social and behavioral sciences, bioengineering, information technology, and assistive technologies. Approaches to expanding research funding and incentivizing research in the area will also be examined. Discussions may include

- mechanisms of aging and regeneration, tissue destruction and repair, and cellular death and survival with a focus on corrective interventions using both conventional means with small molecules and antibodies and emerging therapeutic modalities using cells, genes, nucleic acids, and designer proteins;
- advances in information technologies including the development of large databases, machine learning, and artificial intelligence tools that will inform approaches to therapeutic interventions but also to enhancing quality of life;
- emerging engineering technologies based on software and mechanical design that hold promise for monitoring the health and activity of the elderly as well as enhancing their mobility and functionality to help them continue to live productive lives; and

- implications for investment in research and development, regulation, commercialization, and scalability, including issues pertaining to ethics and equality.

Workshop speakers and discussants will be drawn from government, academia, private, civil society, and nonprofit sectors from the local to global levels. Proceedings of the workshop discussions will be prepared by a designated rapporteur in accordance with institutional guidelines as part of a three workshop series on healthy longevity.

Day 1 – Tuesday, June 15

5:00pm   **Welcome Remarks**
          VICTOR DZAU, President, National Academy of Medicine

          Workshop Overview, Goals, and Framework
          ANN AERTS, Co-Chair of the Workshop, Head of Novartis
          Foundation
          TACHI YAMADA, Co-Chair of the Workshop, Venture Partner,
          Frazier Healthcare Partners

SESSION 1 — Transformative Advances in Biological Sciences for Healthy Longevity

5:10pm   Session 1 Objectives:
          - Explore critical biological mechanisms of aging and their implications for predicting, preventing, diagnosing, and treating disease across diverse populations
          - Consider emerging scientific advances enabling a healthy longevity future for individuals and societies
          - Discuss knowledge gaps needing research which will create opportunities for advancing science in the longevity field

          Plenary Keynote
          ERIC VERDIN, The Buck Institute

5:30pm   **Expert Discussion**
          Moderator: TACHI YAMADA

6:50pm   **Conclusion**

7:00pm   **Break**

SESSION 2 — Transformative Advances in Technologies for Aging Societies

7:15pm   Session 2 Objectives:
- Describe existing technology and engineering innovations enabling people to function within their physical and social environments
- Explore the potential of emerging technology and engineering developments to promote better health and well-being across the life course
- Highlight critical gaps in technology and engineering research and development, focusing on cocreated and problem-driven solutions

         Plenary Keynote
Speaker: JOE COUGHLIN, Massachusetts Institute of Technology, AgeLab

7:35pm   **Expert Discussion**
Moderator: MEHMOOD KHAN, Life BioSciences, Inc.

8:55pm   **Conclusion**

Day 2 – Thursday, June 17

9:00am   **Welcome and Recap of Day 1**
TACHI YAMADA, Venture Partner, Frazier Healthcare Partners

SESSION 3 — Implementing Advances in Science and Technology to Enable Healthy Longevity

9:05am   Session 3 Objectives:
- Identify successful deployment and scaling of science and technology in building accessible, equitable, and health-promoting living environments
- Discuss strategies to finance and build infrastructure while ensuring public participation in building science- and technology-enabled societies
- Further discuss actions to reform research and development ecosystems to break down silos and encourage holistic systems approaches
- Consider the ethical, equity, and accessibility implications of science and technology, including strategies to prevent and mitigate negative outcomes such as the digital divide

Plenary Keynote
MICHELE GRIMM, Professor, Department of Mechanical
Engineering, Michigan State University

9:25am   **Expert Discussion**
Moderator: ANN AERTS, Novartis Foundation

10:45am   **Conclusion**

11:00am   **Break**

Session 4 — Opportunities and Gaps in Science and Technology

11:15am   **Welcome and Overview**
Moderator: TACHI YAMADA, Frazier Capital Partners

11:20am   **Visionary Statements on Opportunities and Gaps**
TOM CHEUNG, Professor, Division of Life Science, Hong Kong
University of Science and Technology

11:30am   ELENA BONFIGLIOLI, Managing Director Health and Life
Sciences, Microsoft

11:40am   SELINA SEAH, Director, Centre for Healthcare Assistive and
Robotics Technology

11:50am   **Expert Discussion**
Moderators: ANN AERTS and TACHI YAMADA

12:50pm   **Conclusion and Final Remarks**
ANN AERTS

1:00pm   **Adjourn**

Appendix E

Commissioner and Staff Biographies

LINDA P. FRIED (*Co-Chair*) is the dean of Columbia University's Mailman School of Public Health and a leader in the fields of epidemiology and geriatric medicine. Since 2006, she has served as a member of the Aging Society Network, an international MacArthur Foundation think tank whose purpose is to create a roadmap to a successful society of longer lives. She has proposed the concept of a Third Demographic Dividend that enables society and individuals of all ages to experience the benefits of now longer lives, based on innovation in design of society's environments and roles for older adults. She has served as the principal investigator (PI) for major longitudinal cohort studies, including the Cardiovascular Health Study (1989–2008; National Heart, Lung, and Blood Institute [NHLBI]) and the Women's Health and Aging Studies I (1990–2008; National Institute on Aging [NIA]) and II (1993–2008; NIA). She received the National Institutes of Health (NIH) MERIT Award to determine the pathophysiology of frailty (1998–2008; NIA) and served as the director of the Johns Hopkins Functional Status Laboratory (1987–1995). She has also served as the PI of NIH-funded randomized controlled trials, including the Goals for Eating and Moving trial of gingko biloba (NHLBI). She is the codesigner of AARP's Experience Corps and coled the initial national and Baltimore-based implementation and evaluation. At Johns Hopkins, she served as the director of the Center on Aging and Health, the director of the Division of Geriatric Medicine, and the director of the Training Program in the Epidemiology and Biostatistics of Aging. She was also founding PI of the Johns Hopkins Older Americans Independence Center (Pepper Center; NIA) and co-PI of the NIA-funded Demography of Aging Center. She chaired the Johns Hopkins University President's Task Force on the Status of Women in Academic Medicine.

JOHN EU-LI WONG (*Co-Chair*) is the Isabel Chan Professor in Medical Sciences and the senior vice president of health innovation and translation at the National University of Singapore. A medical oncologist-hematologist, he is actively involved in the development of biomedical sciences as a key pillar of Singapore's economy and in the development of Singapore's first academic health system linking the National University Hospital and its medical, public health, dental, and nursing schools under one unified governance. He represents Singapore in the M8 Alliance of Academic Health Centers and the Association of Academic Health Centers International. He is a member of the World Economic Forum Global Agenda Council on Personalized and Precision Medicine, the Nature Index Panel of Senior Medical Advisors, the international editorial board of the *American Journal of Medicine*, and the editorial board of the *Journal of the American Medical Association*. He cofounded the Cancer Therapeutics Research Group, a multinational consortium of nine academic institutions, and has served as a member of the International Education Council for Molecular Targeted Therapy for Cancer, the American Society of Clinical Oncology International Affairs Committee, and the International Oncology Foundation Advisory Board. His research interests are in the development of new drugs, new treatment strategies, and the differences between Asian and Caucasian cancers. He received the degree of doctor philosophiae honoris causa from the Hebrew University of Jerusalem in 2019, the Public Administration Medal (Gold) from Singapore National Day Awards in 2016, and Singapore's President's Science & Technology Medal in 2014, among many other awards. He is a fellow of the Academy of Medicine Singapore, the Royal College of Physicians in Edinburgh and London, and the American College of Physicians. He was elected as an international member of the U.S. National Academy of Medicine in 2019.

ISABELLA ABODERIN is a professor of gerontology and the Perivoli Chair in Africa Research and Partnerships at the University of Bristol. Previously, she was an associate professor in gerontology at the University of Southampton. She joined the Centre for Research on Ageing in October 2013 and concurrently held a position as a senior research scientist at the African Population and Health Research Center in Nairobi, Kenya, where she led a program on aging and development in sub-Saharan Africa. From 2007 to 2013, she worked at the Oxford Institute of Population Ageing as a senior research fellow and between 2004 and 2007 as a research fellow. Prior to joining the Oxford Institute, she worked as a technical officer in the World Health Organization Unit on Ageing and the Lifecourse and as a research associate at the International Institute on Health and Ageing at the University of Bristol. Her professional roles include serving as the Africa regional chair of the International Association of Gerontology and Geriatrics, the technical adviser for the Global Commission on Ageing in Developing Countries, and a member of the World Economic Forum Global Agenda Council on Ageing. She completed a Ph.D. in social policy studies at the University of

Bristol, an M.Sc. in health promotion sciences at the London School of Hygiene & Tropical Medicine, and a B.Sc. in cellular and molecular pathology at the University of Bristol.

ANN AERTS is the head of the Novartis Foundation, an organization committed to transforming the health of low-income populations, working with partners on in-country programs and research to identify the health care solutions that work best, supporting partners in scaling up proven solutions, and using the new evidence to inform national and global health policy. She has led initiatives to improve cardiovascular health in urban populations, co-chaired a Broadband Commission working group that developed recommendations for using digital health to tackle noncommunicable diseases and achieve universal health coverage, and led a leprosy prevention program that influenced World Health Organization guidelines. Her career has focused on patient-centered care, spanning the international humanitarian sector, nonprofits, and the pharmaceutical industry. She was previously the franchise medical director for critical care at Novartis Pharma in Basel and the therapeutic area head of cardiovascular and metabolism for Novartis Pharma in Belgium. Prior to joining Novartis, she served as the director of the Lung and Tuberculosis Association in Belgium, the head of the Health Services Department of the International Committee of the Red Cross (ICRC) in Geneva, and the health coordinator for ICRC in several countries. In 2014, PharmaVOICE nominated her as one of the 100 Most Inspiring People in the life science industry. She has authored numerous publications and is a member of the Broadband Commission, the Governing Council of the United Nations Technology Bank for Least Developed Countries, and the International Advisory Board of the Commonwealth Centre for Digital Health. She holds a degree in medicine and a master's in public health from the University of Leuven, Belgium, and a degree in tropical medicine from the Institute of Tropical Medicine in Antwerp, Belgium.

JOHN BEARD works globally with academia, policy makers, and the private sector to reimagine the second half of life. He is a professor with the University of New South Wales, the chief advisor for the European Institute of Innovation and Technology Health consortium, and a visiting professor at Toulouse and Peking universities. He also has a number of private-sector appointments. From 2009 to 2019, he was the director of aging and life course with the World Health Organization (WHO) in Geneva, serving as the editor and the author for the *World Report on Ageing and Health*, which formed the basis for the 2016 *Global Strategy and Action Plan on Ageing and Health* that provides a political mandate for global action. In 2012, he established the WHO Global Network of Age-friendly Cities and Communities, which now comprises more than 1,000 cities and countries covering more than 250 million people. Other projects developed by his team include the Integrated Care for Older People program, a global campaign

to combat ageism and reframe the way we think about aging and older age, and to work with research partners to identify and fill the many knowledge gaps in the field of aging. He was the coeditor of the 2014 *Lancet* series on aging. Prior to joining WHO, he held a range of senior public health and academic roles in Australia and the United States. He remains actively involved in several large international research projects on healthy aging.

LISA BERKMAN is the director of the Harvard Center for Population and Development Studies (HCPDS) and the Thomas D. Cabot Professor of Public Policy, Epidemiology, and Global Health and Population at the Harvard T.H. Chan School of Public Health. She is an internationally recognized social epidemiologist whose work focuses extensively on social and policy influences on health outcomes. Her research orients toward understanding inequalities in health related to socioeconomic status; different racial and ethnic groups; and social networks, support, and isolation. She is the principal investigator of Health and Aging in Africa: A Longitudinal Study of an INDEPTH Community in South Africa (HAALSI), a program funded by the National Institute on Aging. HAALSI aims to study the drivers and consequences of HIV and noncommunicable diseases in an aging population in Agincourt, South Africa. Prior to becoming the director of HCPDS, she was the chair of the Department of Society, Human Development and Health at the Harvard T.H. Chan School of Public Health (1995–2008) and the head of the Division of Chronic Disease Epidemiology at Yale University.

LAURA L. CARSTENSEN is a professor of psychology at Stanford University, where she is also the Fairleigh S. Dickinson Jr. Professor in Public Policy and the founding director of the Stanford Center on Longevity. For more than 25 years, her research has been supported by the National Institute on Aging (NIA), and she has been honored with two MERIT awards. Her most recent empirical research focuses on ways in which motivational changes influence cognitive processing. She is a fellow of the Association for Psychological Science, the American Psychological Association, and the Gerontological Society of America. She was a member of the MacArthur Foundation's Research Network on an Aging Society and served on NIA's National Advisory Council on Aging. She has received numerous awards, including the Kleemeier Award, the Richard Kalish Award for Innovative Research, the Distinguished Mentorship Award from the Gerontological Society of America, and the Master Mentor Award from the American Psychological Association. She was selected as a Guggenheim fellow in 2003 and was inducted into the U.S. National Academy of Medicine in 2016. In 2011, she authored *A Long Bright Future: Happiness, Health, and Financial Security in an Age of Increased Longevity.* She received a B.S. from the University of Rochester and a Ph.D. in clinical psychology from West Virginia University. She holds an honorary doctorate from the Katholieke Universiteit Leuven, Belgium.

MICHELE J. GRIMM is the Wielenga Creative Engineering Endowed Professor of Mechanical Engineering at Michigan State University. She is a fellow of the American Society of Mechanical Engineers, the Biomedical Engineering Society, and the American Institute of Medical and Biological Engineering. For the past 25 years, a significant portion of her research has involved injury biomechanics, from characterizing important tissue properties to developing appropriate models for the assessment of injury mechanisms. She recently finished a 3-year rotation as a program director at the National Science Foundation, overseeing the Biomechanics and Mechanobiology, Engineering of Biomedical Systems, and Disability & Rehabilitation Engineering programs. During this time, she served as a co-chair of the White House's Office of Science and Technology Policy Task Force on Research and Development for Technology to Support Aging Adults. She completed a B.S. in biomedical engineering and engineering mechanics at Johns Hopkins University and a Ph.D. in bioengineering at the University of Pennsylvania.

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MEHMOOD KHAN is the Chief Executive Officer, Hevolution Foundation. He is a sustainability expert and a seasoned leader in research and development

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JEANETTE VEGA MORALES is the minister of Social Development and Family in Chile. Previously, she served as the chief medical and innovation officer at Red de Salud UC-Christus, the main private health care provider in Chile. With more than 20 years of experience in international health, her areas of expertise include social determinants of health, health equity, and health systems. She is the former director of FONASA, the national Chilean public health insurance agency (2014–2018), and the former vice minister of health (2008–2010). She has also served as the managing director of health at The Rockefeller Foundation (2011–2014). Previously she was a director at the World Health Organization, where she led the equity in health agenda and the Commission on Social Determinants of Health, established in March 2005 to support countries and global health partners in addressing the social factors leading to ill health and health inequities. She is a member of many international commissions and boards, and has served as the chair of the Strategic Advisory Board of the Alliance for Health Policy and Systems Research and as a board member of the Harvard Ministerial Leadership Program. She is a regular speaker, chair, and moderator at global health meetings, and has helped organize major international conferences. She has published extensively in peer-reviewed journals, including *The Lancet* and the *Bulletin of the World Health Organization*. She also led the Lancet series on universal health coverage in Latin America.

MOSA MOSHABELA is currently an associate professor and the dean in the School of Nursing and Public Health, University of KwaZulu-Natal, South Africa. A qualified physician in family medicine and primary health care, he works as a chief medical specialist in rural health medicine, and as a public health scientist in health services, systems, and policy, with the aim of improving ac-

cess, quality, and equity in health care. His current research on implementation science and people-centered approaches seeks to design, implement, and evaluate complex interventions in public health care services and programs in ways appropriate for resource-poor settings in sub-Saharan Africa. He is adjunct faculty and a Wellcome Trust research fellow at the Africa Health Research Institute in South Africa. He collaborates with the London School of Hygiene & Tropical Medicine and conducts research in several countries in sub-Saharan Africa. His current research is funded by the National Research Foundation in South Africa, the Medical Research Council and the Wellcome Trust in the United Kingdom, and the National Institutes of Health in the United States. He was a member of the Lancet Commission on Synergies between Health Promotion, Universal Health Coverage and Global Health Security (2018–2020); a member of the U.S. National Academies of Sciences, Engineering, and Medicine's Committee on Human Resources for Health in Rwanda (2018–2020); and the national chairperson of the Rural Doctors Association of South Africa (2016–2019). Previously, he was the regional health systems advisor for the Millennium Villages in West and Central Africa, based at the MDG Centre in Mali/Senegal, and worked with the Earth Institute at Columbia University in the United States. He also served as the senior lecturer in the School of Public Health at the University of Witwatersrand, Johannesburg, where he was the director of the Rural AIDS and Development Action Research Programme.

HIROKI NAKATANI is currently a visiting professor at the Keio University School of Medicine. He has also served as an invited professor at the Osaka University Graduate School of Medicine and in various national and international organizations, including as the chair of the board of directors, Global Health Innovative Technology Fund; as a senior advisor, Economic Research Institute for the Association of Southeast Asian Nations and East Asia; and as the hub director of population aging, Association of Pacific Rim Universities. He has been a public health specialist for more than 40 years, having started his career at the Ministry of Health, Labour, and Welfare in Japan. He has worked extensively in health policy, public health, international health, and health science and technology. His national career includes serving as the director-general of health and welfare services in Hiroshima Prefecture, where he was in charge of integrating health and welfare services in preparation for the arrival of a rapidly aging society. He joined the World Health Organization (WHO) headquarters as policy analyst in the Department of Human Resources for Health. In March 2007, he was appointed as the assistant director-general of WHO, leading the largest technical cluster on HIV/AIDS, Tuberculosis, Malaria, and Neglected Tropical Diseases. During his tenure, the morbidity and mortality of the three significant infections showed decline trends, and a few tropical diseases (dracunculiasis or guinea worm disease) were on track toward elimination and even eradication. After his retirement from WHO in May 2015, he has continued to serve the organization

as a member of the WHO Executive Board, serving as the chair of the board from 2019 to 2020, and as a member of various oversight and advisory committees.

JOHN PIGGOTT is the director of the Australian Research Council's Centre of Excellence in Population Ageing Research and the Australian Institute for Population Ageing Research at the University of New South Wales (UNSW), where he is the Scientia Professor of Economics. He has held a range of academic management positions at UNSW, including two terms as the head of economics and 7 years as the associate dean of research, and he served for more than 1 year as the interim dean of the Faculty of Commerce and Economics. In 2016, he was reelected as a member of the University's Council. He has a long-standing interest in retirement and pension economics and finance. His publications include more than 100 journal articles and chapters in books, and he has also coauthored two books, both published by Cambridge University Press. In 2016, he coedited two volumes on aging: *Handbook of the Economics of Population Ageing* and *Population Ageing and Australia's Future*. He serves as the book review editor of the *Journal of Pension Economics and Finance*, as an associate editor of the *Journal of the Economics of Ageing*, and as a member of the editorial board of the *Journal of Retirement*. His Australian policy experience includes membership on both the Henry Tax Review Panel and the Ministerial Superannuation Advisory Committee. Internationally, he has worked with the governments of Japan, Russia, and Indonesia on pension and aging issues, and in 2004, he was tasked with evaluating assistance on pension reform in the Asia region for the World Bank's Operations Evaluation Department. In 2007, he was appointed as a visiting professor at Zhejiang University, China, and from 2008 to 2010 was a visiting scholar with the Department of Insurance and Risk Management at the University of Pennsylvania Wharton School of Business.

JENNIE POPAY (*commission member until July 2021*) is a professor of sociology and public health in the Division of Health Research at Lancaster University; she is also the director of the Centre for Health Inequalities and the codirector of the Liverpool and Lancaster Universities Collaboration for Public Health Research. She is the director of engagement and public health lead for the National Institute of Health Research Collaboration for Leadership in Applied Health Research and Care for the Northwest Coast. She is the principal investigator for the Communities in Control Study, an evaluation of a lottery-funded community empowerment initiative, and she leads a program involving the production of an online resource to help researchers design studies that are more equity sensitive. She has completed studies of the health equity and social impact of the New Deal for Communities regeneration initiative and a Medical Research Council study on methods to assess the impact of public involvement in research. She has undertaken a number of innovative systematic reviews of qualitative research evidence and findings from studies, and she led a team that developed guidance

on narrative synthesis—a method for reviewing and synthesizing findings from multiple mixed-methods studies. She served as cocoordinator of the Global Social Exclusion Knowledge Network supporting the World Health Organization (WHO)-sponsored Commission on the Social Determinants of Health (the Marmot Commission), and as the chair of the Disadvantage, Social Exclusion and Vulnerability Task Group, supporting the work of the WHO EURO review of social determinants of health (2010–2012). She has held a number of public appointments including as the vice chair of the Commission on Patient and Public Involvement in Health, a member of the Bevan Commission in Wales, and the commissioner of the Commission on Health Improvement. She was the inaugural chair of the national charity The People's Health Trust.

JOHN (JACK) W. ROWE is the Julius B. Richmond Professor of Health Policy and Aging at Columbia University's Mailman School of Public Health. Previously, he served as the chair and chief executive officer (CEO) of Aetna, Inc., and as the president and CEO of Mount Sinai New York University (NYU) Health. Prior to the Mount Sinai-NYU Health merger, he was the president of Mount Sinai Hospital and the Mount Sinai School of Medicine in New York City. Before joining Mount Sinai, he was a professor of medicine and the founding director of the Division on Aging at the Harvard Medical School, as well as the chief of gerontology at Boston's Beth Israel Hospital. He was the director of the MacArthur Foundation Research Network on Successful Aging, and he coauthored the book *Successful Aging*. He currently leads the MacArthur Foundation's Network on an Aging Society. He was elected a fellow of the American Academy of Arts & Sciences and a member of the U.S. National Academy of Medicine. He serves on the board of trustees of The Rockefeller Foundation and is the chair of the board of overseers of the Mailman School of Public Health and the board of fellows of Harvard Medical School. He was the founding chair of the advisory council for Stanford University's Center on Longevity, a founding commissioner of the Medicare Payment Advisory Commission, and the chair of the board of trustees of the University of Connecticut and the Marine Biological Laboratory.

ANDREW J. SCOTT is a professor of economics at the London Business School, having previously held positions at Oxford University, the London School of Economics, and Harvard University. His work focuses on the economics of longevity, and he is the coauthor of *The 100-Year Life* and *The New Long Life*. He was the managing editor for the Royal Economic Society's *The Economic Journal* and the nonexecutive director for the United Kingdom's Financial Services Authority. He is currently on the advisory board of the UK Office for Budget Responsibility and is a member of the Cabinet Office Honours Committee (Science and Technology). He is the cofounder of The Longevity Forum, a member of the World Economic Forum Council on Healthy Ageing and Longevity, and a consulting scholar at Stanford University's Center on Longevity. He received a

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ERIC VERDIN is the president and the chief executive officer of the Buck Institute for Research on Aging. He has held faculty positions at the University of Brussels in Belgium, the National Institutes of Health (NIH) in Maryland, and the Picower Institute for Medical Research in New York. He studies the molecular virology of HIV and novel approaches to eradicate HIV infection. His laboratory also focuses on a family of proteins called histone deacetylases and their role in the aging process and the immune system. He joined the Gladstone Institute of Virology and Immunology in 1997 and became its associate director in 2004. He is an elected fellow of the American Association for the Advancement of Science, and a member of the American Society for Clinical Investigation and the Association of American Physicians. He serves on the National Scientific Advisory Council of the American Federation for Aging Research and on the Advisory Council of the National Institute of Drug Abuse at NIH. He has served as a reviewer on study sections for NIH, as the organizer of international meetings, and as the editor of several books and reviews. He has published more than 200 international papers and is an inventor on 14 published patents. He earned an M.D. from the University of Liege and trained at Harvard Medical School.

YAOHUI ZHAO is a professor of economics at the China Center for Economic Research of Peking University. Her research focuses on labor market issues in China, including determinants and consequences of rural-to-urban labor migration, wage differentials, and returns to education. Recently, she has begun to conduct research in the economics of health and aging, such as the socioeconomic status gradients of health, underdiagnoses of chronic diseases among the older population, and labor supply and living arrangements for older people. Since 2007, she has been the principal investigator of the China Health and Retirement Longitudinal Study, with a nationally representative sample of Chinese residents aged 45 and older. She received a B.A. and an M.A. from Peking University and a Ph.D. from the University of Chicago.

PROGRAM STAFF

MAUREEN HENRY (*Study Director*) is a senior program officer with the Global Roadmap for Healthy Longevity at the National Academies of Sciences, Engineering, and Medicine. Prior to joining the National Academies, she spent 4 years as a research scientist at the National Committee for Quality Assurance, developing performance measures related to the care of older people, including outcome measures based on people's care goals. She served as a Health and Aging Policy Fellow in the office of Senator Mark Warner in 2013 and as the executive director of the Utah Commission on Aging from 2005 to 2012, where

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EMMA LOWER-MCSHERRY (*Senior Program Assistant*) is on the staff of the Healthy Longevity Global Grand Challenge at the National Academies of Sciences, Engineering, and Medicine. Prior to joining the National Academies, she interned with the Peace Corps and the U.S. Department of State, Bureau of Population, Refugees, and Migration, coordinating with relevant agencies and international actors to support global health initiatives. Additionally, she conducted donor outreach to secure funds for migrant youth programs at the Nationalities Services Center in Philadelphia. She holds a B.A. in political science and a minor in global security from Temple University, where she completed research on modern migration trends, refugee crises, and humanitarian affairs. During her time at Temple University Rome, she served as an English teacher at a refugee center where she assisted clients with language development and obtaining health services. Currently, she volunteers as an English Language Partner through the Hebrew Immigrant Aid Society to support asylum seekers in the Washington, DC, area.