McKinsey Health Institute

Healthspan science may enable healthier lives for all

Biomedical interventions that materially affect the aging process and improve health outcomes may emerge in the future. Stakeholders can shape their roles in this potentially transformative field now.

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Executive summary

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"Healthspan" refers to the years of life spent in good or great health and free from serious diseases or disabilities. An established body of evidence shows that nutrition, sleep, physical activity, appropriate stress levels, social connection, and a conducive environment allow people to live more years in good health and improve their overall longevity. Now, innovators are investigating complementary biomedical tools intended to help people remain healthy for longer. The McKinsey Health Institute (MHI) has extensively examined the drivers that increase healthspan, with particular deep dives on the focus areas of brain health, metabolic health, and women's health. This specific report will not look at behavioral or ecosystem drivers of health and instead focus entirely on biomedical innovation targeting biological aging processes—which could have implications for many angles of human health, including these areas.

Healthspan science,[1] which focuses on biomedical innovations that target the biological aging process and contribute to healthy longevity, is a fast-growing field. The five-year average for investment quadrupled in the past decade, and clinical trial initiation has grown 27 percent over five years, leading to a pipeline of several hundred drug candidates.[2] The field is expected to continue growing, but there is no consensus on when biomedical innovations that can meaningfully target fundamental aging processes are likely to emerge.

Improved healthspans could have enormous benefits on society. Age-related diseases—including cancers, neurodegenerative conditions such as Alzheimer's, and musculoskeletal conditions such as arthritis—account for more than 600 million disability-adjusted life years (DALYs)[3] annually, or one-third of the total global burden of disease.[4] Addressing half of this burden could lead to fewer early deaths and less time spent in poor health, and it could translate to as much as about $2 trillion[5] in annual GDP uplift due to increased employment from

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1 In this report, we use the term "healthspan science" to refer to biomedical innovations that target the aging process. Other terms include "geroscience," "precision geromedicine," and "healthy longevity science."
2 McKinsey analysis of 2024 longevity and healthspan data from ClinicalTrials.gov and PitchBook.
3 One DALY represents the loss of one year of full health. DALYs are the sum of years of life lost due to premature mortality and years of life lived with disability.
4 McKinsey Health Institute analysis of Global Burden of Disease 2022 data; Angela Y. Chang, "Measuring population ageing: An analysis of the Global Burden of Disease Study 2017," *The Lancet Public Health*, March 2019, Volume 4, Number 3.
5 MHI analysis. Calculated in a scenario-based simulation sizing three effects: increase of life expectancy ("extending"), decrease of lifetime spent in poor health, and decrease of lifetime in moderate rather than good health ("lifting" and "squaring the curve"). Data sources comprise healthy life expectancy data, WHO data, health system data, life-expectancy data for more than 20,000 administrative regions globally, and Prioritizing health: A prescription for prosperity, McKinsey Global Institute, July 8, 2020. The McKinsey Health Institute's aspiration to add six years of higher-quality life on average goes significantly beyond delaying the average onset of disease from, for example, 55 to 65 years mentioned in the *Prioritizing health* report.

an expanded adult workforce. The potential to enable people to live healthier for longer through new tools is more relevant now as societies look to address shifting demographics, lower birth rates, and smaller dependency ratios, which are putting social security and health systems at risk.[6]

To accelerate progress in healthspan science and realize the potential benefits these innovations could have on society, the field could advance efforts across seven dimensions:

1. *Field definition and perception*. Stakeholders can align with one another to establish a narrative focused on healthspan that helps convey measured optimism and is fully backed by science.
2. *Fundamental understanding of aging biology*. Stakeholders can orchestrate a global research agenda that focuses on areas with the most potential and determines how to accelerate them. This research can be supported by AI, machine learning (ML), and comprehensive data sets.
3. *Biomarker consensus*. Stakeholders could build a consensus on which priority biomarkers could serve as surrogate endpoints for clinical trials to benchmark interventions.
4. *Translation and clinical development*. Healthspan science needs more clinical-development expertise. Embedding AI and cutting-edge R&D approaches, such as AI-driven iterative testing systems, innovative trial design, and “reverse translating” by making biospecimens and data from trials available to basic scientists can enable discoveries of new clinical targets and the underlying causes of age-related diseases.
5. *Regulatory pathways*. Healthspan-related therapies need a new or existing chartered approval path to enable populations to access safe and effective innovative solutions.
6. *Derisked investment*. Research funders, pharmaceutical companies, and blue-chip life science investors could work alongside venture capitalists and high-net-worth-individuals or philanthropists to provide expertise, scale, and stability.
7. *Evidence-based practice and talent*. Stakeholders can help develop practitioner talent globally, including healthspan-oriented clinicians and researchers as well as among academic leaders (for example, university presidents, deans, health system CEOs), to facilitate clinical development and public access to innovative healthspan interventions.

Of course, progress on biomedical tools should not reduce the focus on better addressing and refining potential lifestyle drivers of healthspan, such as sleep, exercise, stress, and nutrition. These should continue to be explored in conjunction with any emerging tools.

It’s worth asking whether now is the right time for a broader set of stakeholders to invest in healthspan science. On the one hand, the potential is large; on the other hand, there are uncertainties that are difficult for any individual player to manage. Concerted action and coalitions across sectors could be the

[6] “Dependency and depopulation? Confronting the consequences of a new demographic reality,” McKinsey Global Institute, January 15, 2025.

most effective way to advance the field. Each stakeholder could contribute its unique capabilities—for example, the development expertise of pharmaceutical companies; the innovation capabilities and agility of biotech companies; the training and research capabilities of universities and hospitals; the scale and experience of traditional life sciences investors; the policy, regulatory, and funding roles of government; and the financial resources that philanthropists and foundations can access.

Moreover, technology companies can advance AI and data capabilities in the field, and payers can provide commercial models while stewarding the population health impact of interventions. The public can also have a voice in the field—consumers are becoming increasingly interested in markets related to healthy longevity, such as supplements and health-related wearables.

To get started, cross-stakeholder collaboration could address specific themes, potentially under the umbrella of an acceleration coalition. For example, blended finance can scale investment in healthspan science by improving risk profiles for investors. A global data collaboration could help develop and connect data sets to establish fit-for-purpose endpoints and signal-seeking trials on the interventions with the most potential.

Mainstream life sciences investors, governments (including regulators), research funders, media outlets, ethicists, and the public have an opportunity to better understand healthspan science, realize the concrete benefits of investing in the field, and prepare for a possible future in which biomedical interventions will have a meaningful impact on the aging process and the multiple disorders and diseases linked to fundamental aging mechanisms.

This report is intended to initiate a conversation on the potential choices ahead, bringing together stakeholders within the field and those currently outside. All have roles to play, and all stand to benefit from investing in healthy longevity.

1 Healthspan science is an increasingly plausible field for investment

It's common knowledge that "lifespan" refers to how long a person lives. A less discussed, complementary, and increasingly important time frame is "healthspan," or the period of life a person spends in good or great health. The McKinsey Health Institute (MHI) has identified an opportunity for humanity to add as many as 45 billion extra years of higher-quality life over the next decade, which is roughly six years per person, on average.[7] The opportunity may be greater for specific groups. For example, women live longer than men but spend more years in poor health.[8]

Healthspan and the impact of age-related diseases

Age-related diseases and conditions, such as cardiovascular, cancer, or sense organ diseases, account for approximately 633 million disability-adjusted life years (DALYs)[9] annually, or one-third of the total global burden of disease, according to MHI analysis (Exhibit 1).

If interventions could address half of this burden, a share achieved by mature therapeutic areas (TAs) such as cardiovascular disease, they could help recover about $2 trillion[10] in GDP. This would result from fewer premature deaths and improved functional health in later life. In turn, a greater number of older adults could enjoy healthier lives in the community, contributing meaningfully to society—including, but not limited to, extended participation in the workforce.

Almost 15 percent of the global population is expected to be 65 or older by 2040, up from 10 percent today.[11] A rapidly aging population means it is more important than ever to focus not only on lifespan but also on increasing the number of years people spend in good health.[12] The topic is rising on the global agenda: International bodies such as the United Nations and the World Economic Forum have been actively promoting healthy longevity as a topic, making the field more relevant than ever and potentially ripe for investment.

In addition, latent consumer demand for solutions that address age-related poor health is huge. People want to buy products that help them stay in good health for longer. According to McKinsey's 2025 Future of Wellness Survey, up to 60 percent of consumer respondents consider healthy aging or longevity to be a "top" or "very important" priority.[13]

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7 Calculated in a scenario-based simulation sizing three effects: increase of life expectancy ("extending"), decrease of lifetime spent in poor health, and decrease of lifetime in moderate rather than good health ("lifting" and "squaring the curve"). Data sources comprise healthy life expectancy data, WHO data, health system data, life-expectancy data for more than 20,000 administrative regions globally, and *Prioritizing health: A prescription for prosperity*, McKinsey Global Institute, July 8, 2020. The McKinsey Health Institute's aspiration to add six years of higher-quality life on average goes significantly beyond delaying the average onset of disease from, for example, 55 to 65 years mentioned in the *Prioritizing health* report.

8 Kweilin Ellingrud, Lucy Pérez, Anouk Petersen, and Valentina Sartori, *Closing the women's health gap: A $1 trillion opportunity to improve lives and economies*, McKinsey Health Institute, January 2024.

9 One DALY represents the loss of one year of full health. DALYs are the sum of years of life lost due to premature mortality and years of life lived with disability.

10 MHI analysis based on a scenario-based simulation leveraging World Bank GDP per capita data (2022) and International Labour Organization labor force participation rate and unemployment rate data (2022). Calculated using three factors: boosted labor supply from lower mortality (additional population avoided for ages 15 and up multiplied by labor force participation, employment rate, and GDP per employed person); boosted labor supply from lower morbidity (additional time in years lived with disability saved for ages 15 and up multiplied by employment rate and GDP per employed person); and growth in workforce supply from increased labor force participation in older cohorts (increase in participation of 65–69 age group multiplied by incremental labor force participation rate, employment rate, and GDP per employed person, with a 50 percent discount factor).

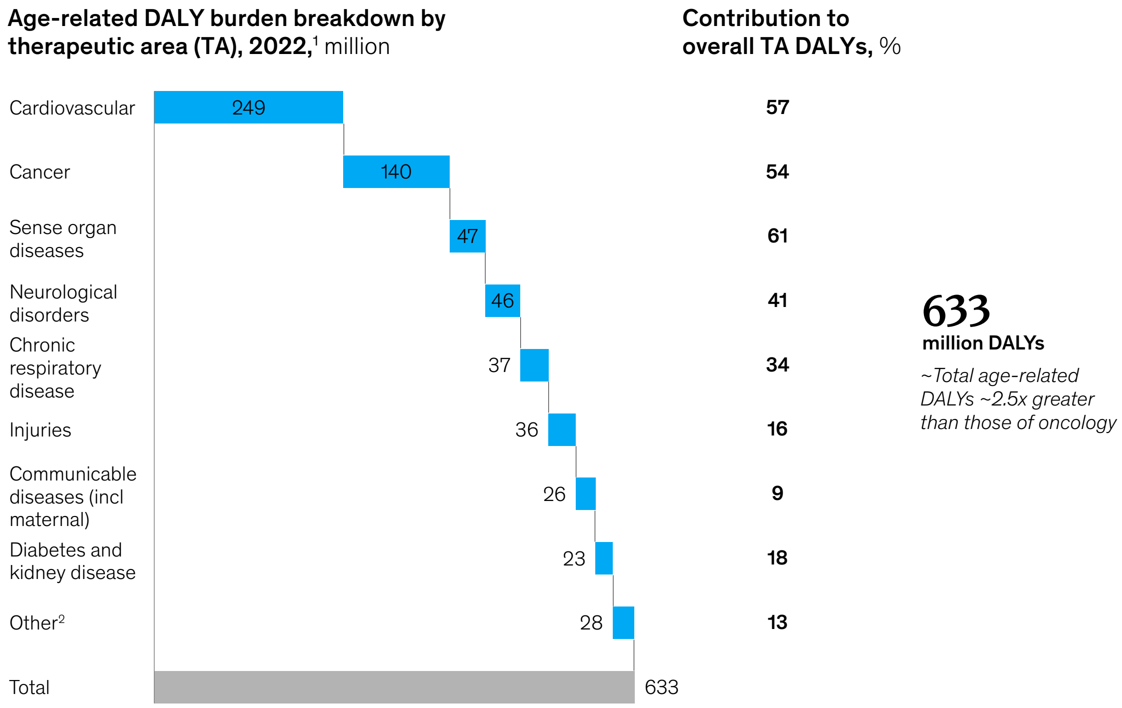
11 "UN Population Division Data Portal," United Nations, accessed 2022; Martin Dewhurst, Katherine Linzer, Madeline Maud, and Christoph Sandler, "Living longer in better health: Six shifts needed for healthy aging," McKinsey Health Institute, November 11, 2022.

12 Andrew Scott posits that more healthy years—referred to as a compression of morbidity—is more valuable to people and society than extended life expectancies; see Andrew Scott, Martin Ellison, and David Sinclair, "The economic value of targeting aging," *Nature Aging*, 2021, Volume 1. Scott's calculations are made based on willingness to pay, which takes into account the value of each remining year of life, including quality of life (for example, health, consumption, and leisure), and survival rate (to discount to present-day considerations).

13 "The $2 trillion global wellness market gets a millennial and Gen Z glow-up," McKinsey, May 29, 2025.

Exhibit 1

Age-related diseases account for one-third of the total global burden of disease.



Note: DALYs are disability-adjusted life years. Figures do not sum to total, because of rounding.
[1]Calculated by taking the DALYs of 92 age-related diseases outlined in 2019 *Lancet* paper with age groups <5 excluded (eg, maternal and neonatal disorders), then removing non-age-related DALYs attributed to environmental and occupational factors (eg, pollution, chemical exposure) and selected behavioral factors (eg, smoking, alcohol abuse), and finally removing remaining baseline DALYs not linked to aging (for ages <40).
[2]Includes digestive diseases, skin and subcutaneous diseases, and other noncommunicable diseases.
Source: “Global Burden of Disease,” Institute for Health Metrics and Evaluation, 2022; D. Scott Kehler, “Age-related disease burden as a measure of population ageing,” *The Lancet Public Health*, March 2019, Volume 4, Number 3; McKinsey Health Institute analysis

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Healthspan science as a complementary tool for healthy longevity

Healthspan science is the pursuit of extending healthspan and improving function by using biological or medical tools to intervene in the processes of aging.

Individuals currently have access to a wealth of evidence-based strategies that can extend their healthspan and delay the onset of age-related diseases, but these strategies can be challenging to adopt.[14] Changes in habits, such as maintaining a balanced diet and getting regular exercise, are often difficult to commit to, can be more challenging for some people than others based on socioeconomic status and other social determinants of health, and can come too late for individuals who have been less healthy for a long time. Healthspan science aims to complement and expand these existing tools.

[14] Of the 20-plus modifiable drivers of health identified by the McKinsey Health Institute, the majority sit outside healthcare systems and require a virtuous circle of individual and institutional actions. See Lars Hartenstein and Tom Latkovic, “The secret to great health? Escaping the healthcare matrix,” McKinsey Health Institute, December 20, 2022.

Healthspan science is the pursuit of extending healthspan and improving function by using biological or medical tools to intervene in the processes of aging.

Researchers have outlined 14 interacting biological processes that contribute most to aging, dubbed the "hallmarks of aging" (Exhibit 2).[15] Therapeutic interventions that target the hallmarks of aging could potentially help slow down biological aging processes. For example, the association between cellular senescence and multiple diseases, such as Alzheimer's, Parkinson's, and kidney diseases,[16] has spurred research on small chemical compounds that selectively kill senescent cells that could otherwise accelerate the progression of age-related diseases.[17] Typically, interventions on one hallmark also act on other hallmarks.

Aging is a systemic process, and hallmarks are only part of the puzzle. As research advances, additional processes continue to be discovered, such as a person's infection resilience and the role of gerogenes and gerosuppressors.[18] Beyond cellular pathways, psychosocial isolation is also considered a hallmark of aging, emphasizing the importance of participating in society for older adults.[19]

Nonetheless, the hallmarks are accepted as a helpful framework within healthspan science, particularly to identify potential targets in clinical development. Several ongoing clinical trials have focused on drugs that target specific age-related diseases—for example, senolytics and rapalogs, which eliminate or suppress senescent cells.[20]

Humans have historically shown a hope-induced susceptibility to longevity cures, falling victim to claims about reversed aging with no scientific backing.[21] Our judgment is biased when it comes to topics so close to the core of our existence and mortality. It is therefore critical to engage with healthspan science to differentiate evidence from hype and cultivate a clear understanding of the current state of the field, its practical applications, and the most promising directions for future development (see sidebar "Healthspan through a public health lens").

Healthspan science is growing fast yet still in early stages

The healthspan field is nascent and a long way from maturity: For example, no healthspan-related drug or clinical intervention has yet reached the market, and there is much more to understand about the biology of aging. At the same time, there are pockets of concrete opportunity across drug repurposing,[22] using existing mechanisms of action (MOAs) for healthspan-related purposes, and exploring new MOAs.

Still, healthspan science has grown quickly and has a committed core ecosystem of stakeholders. Progress has been made recently in the field across science, clinical trials, and investment:

— The first nine hallmarks of aging were conceptualized in 2013. Thanks to a significant uptake in research activity, the list was expanded in 2023 and 2025.[23] In 2013, approximately 180 published papers referenced healthy longevity. Approximately 1,300 referenced the topic in 2024.[24]

[15] Carlos López-Otín et al., "Hallmarks of aging: An expanding universe," *Cell*, January 2023, Volume 186, Number 2.
[16] Mozhdeh Mehdizadeh et al., "The role of cellular senescence in cardiac disease: Basic biology and clinical relevance," *Nature Reviews Cardiology*, October 19, 2022.
[17] Yi Zhu et al., "The Achilles' heel of senescent cells: From transcriptome to senolytic drugs," *Aging Cell*, August 2015, Volume 14, Number 4 (reports the discovery of senolytics).
[18] Guido Kroemer et al., "From geroscience to precision geromedicine: Understanding and managing aging," *Cell*, 2025, Volume 188, Number 8.
[19] "Aging with purpose: Why meaningful engagement with society matters," McKinsey Health Institute, October 23, 2023; Yi Zhu et al., "The Achilles' heel of senescent cells: From transcriptome to senolytic drugs," *Aging Cell*, August 2015, Volume 14, Number 4.
[20] Carlos López-Otín et al., "Hallmarks of aging: An expanding universe," *Cell*, January 2023, Volume 186, Number 2.
[21] Historical and mythological pursuits of longevity frequently led to extraordinary but misguided efforts. Notably, Mesopotamian King Gilgamesh's quest for eternal youth ended in disappointment when he lost the mythical youth-restoring plant. Similarly, Linus Pauling's widely publicized vitamin C regimen in the 1980s, initially promising significant lifespan extension, was later scientifically disproven, underscoring the importance of evidence-based approaches in longevity research.
[22] Including drugs in development pipelines.
[23] Carlos López-Otín et al., "The hallmarks of aging," Cell, June 2013, Volume 153, Number 6; Carlos López-Otín et al., "Hallmarks of aging: An expanding universe," *Cell*, January 2023, Volume 186, Number 2.
[24] MHI analysis based on PubMed search.

Exhibit 2

Fourteen biological processes contribute the most to aging and affect different systems.

Hallmark	Definition
Genomic instability	Accumulation of DNA damage and the loss of ability to repair damage
Telomere attrition	Telomere shortening with each cell division cycle, compromising genomic integrity
Epigenetic alterations	Changes to how genes are expressed over time, triggered by environmental influences
Loss of proteostasis	Reduced regulation, causing reduced cell viability and misfolded proteins
Disabled macro-autophagy	Decline in cellular ability to deliver damaged organelles and proteins for degradation
Stem cell exhaustion	Decline in tissue renewal as well as impaired tissue repair upon injury
Altered intercellular communication	Loss, misinterpretation, or ignoring of the signaling between cells, interrupting normal tissue function and repair
Chronic inflammation	Increase in inflammatory cytokines and biomarkers with immune decline
Dysbiosis	Disruption in gut bacterial composition, distribution, and activities
Extracellular matrix (ECM) changes	Deposition, degradation, and modification of ECM components
Deregulated nutrient sensing	Cellular inability to sense what nutrients are at hand and communicate with other systems
Mitochondrial dysfunction	Functional deterioration, causing an increase in reactive oxygen species
Cellular senescence	Cessation of cell division while metabolically still active, damaging other healthy tissues
Psychosocial isolation	Enfeeblement of social and affective bonds, as well as their psychological or psychiatric consequences

Note: Aging hallmarks are not exhaustive, and understanding of other biological processes of aging continues to evolve (eg, understanding of the role of extracellular matrix gene exchange).
Source: Guido Kroemer et al., "From geroscience to precision geromedicine: Understanding and managing aging," *Cell*, 2025, Volume 188, Number 8

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- Investment has increased, with the five-year average for biotech financing quadrupling over the past decade from a range of investor types—predominantly venture capital (VC) firms (Exhibit 3).[25]
- The five-year average for trial initiation in the field of healthy longevity has grown by approximately 27 percent since the 2013–17 period. Drug trials represent 74 percent of this activity, while the remaining activity is dedicated to supplements, digital solutions, and lifestyle interventions.[26]

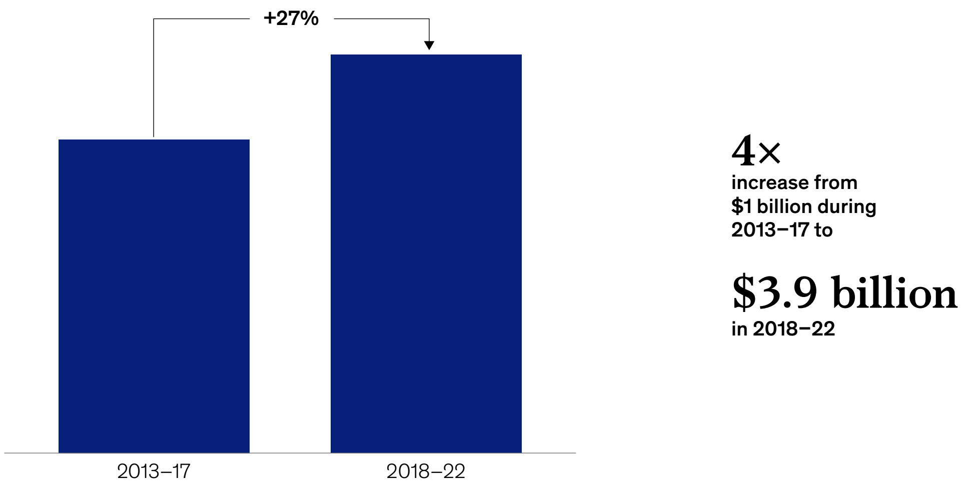
25 MHI analysis of 2024 longevity and healthspan data from ClinicalTrials.gov and PitchBook.
26 “The Rejuvenation Roadmap,” Lifespan Research Institute, updated August 27, 2024.

Exhibit 3

Investment in healthspan science has increased significantly since 2013.

Healthspan science clinical trials initiated in 5-year horizons, cumulative, phases I–IV, 2013–22

Biotech financing in the healthspan field, 5-year average



Source: ClinicalTrials.gov; PitchBook

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Healthspan through a public health lens

Because the healthspan science field is in early stages without approved biomedical innovations, healthspan-related products and markets available today have been driven by consumer demand. Access to drivers of healthy longevity such as good nutrition is already unequal within and across societies, and if healthspan science solutions are not widely accessible, innovations could exacerbate these inequities and benefit only the few who can afford them.

To maximize societal benefit, any meaningful advances in healthspan science should be made with a view to public health. Early examples of this parity include reflections on how to provide healthy-longevity medical services in public hospitals.[1] As the field develops, concerted efforts will be required to pragmatically address potential inequities (including in R&D to ensure that emerging tools work for diverse populations, that sex-based differences are taken into account, and that people have equitable access to these tools) and ethical concerns (including the biological purpose of death and broader societal considerations of longer lives).

1 Sara L. R. Bonnes et al., “Establishing healthy longevity clinics in publicly funded hospitals,” *GeroScience*, October 2024, Volume 46, Number 5.

— An emerging yet very active ecosystem of stakeholders is driving momentum in the field, including research organizations, national institutes (such as the National Institute on Aging and the American Federation for Aging Research [AFAR]), biobanks, biotechnology companies,[27] and investors (such as bespoke VCs and the Hevolution Foundation).

— Pharmaceutical companies are showing increasing interest in healthspan research through partnerships with biotechnology companies and academia. These activities largely focus on developing new treatments for established treatment areas, such as neurodegenerative or metabolic diseases, by intervening in pathways that are related to the biology of aging (Exhibit 4). More pharmaceutical companies are funding early-stage studies, recognizing the potential of the field.

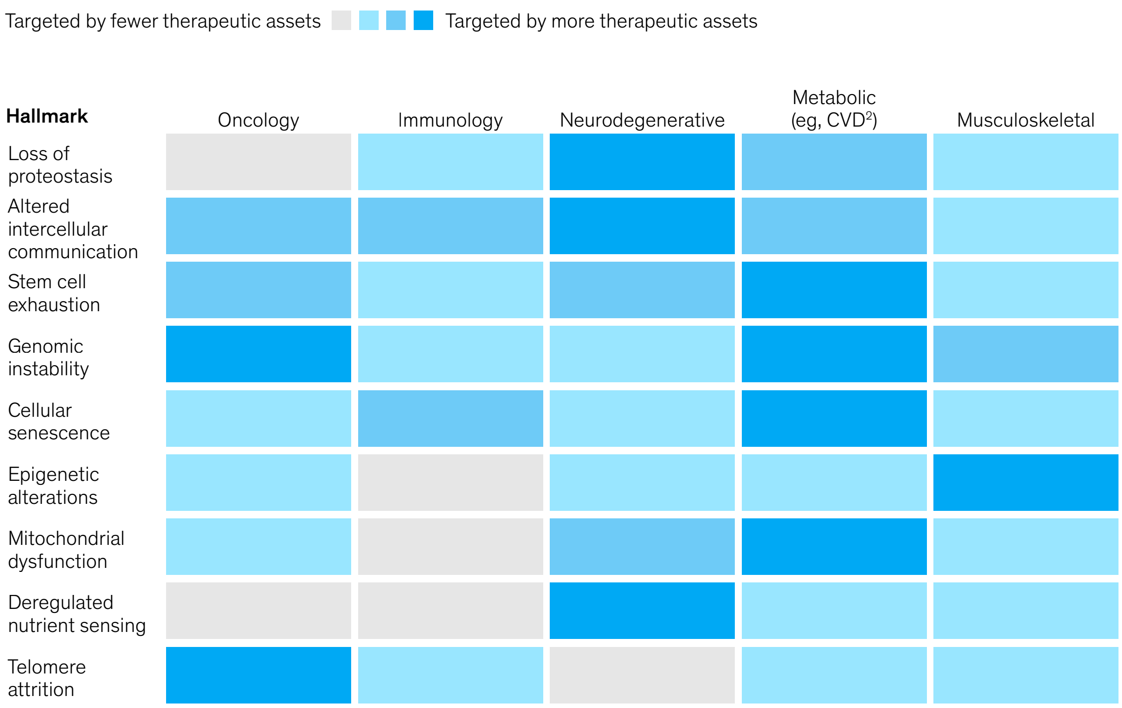
— Healthspan, or healthy longevity, clinics are on the rise but with wide variations. Clinically qualified longevity clinics (which follow standards developed by large entities, such as the Abu Dhabi Department of Health with the Healthy Longevity Medicine Society[28]) could help bridge the gap between healthspan

[27] Nick Taylor, "Altos bursts out of stealth with $3B, a dream team C-suite and a wildly ambitious plan to reverse disease," Fierce Biotech, January 19, 2022.
[28] "Resources & Education," Healthy Longevity Medicine Society, accessed August 19, 2025.

Exhibit 4

Clinical trial pipelines for age-related diseases address hallmarks of aging that affect neurodegenerative and metabolic conditions.

Key therapeutic areas addressed, number of molecules[1]



Note: Only includes assets in development; 23 assets were excluded from this analyses due to missing information; total n displayed = 177
[1]Not mutually exclusive; double counts possible.
[2]Cardiovascular disease.
Source: Citeline; "The Rejuvenation Roadmap," Lifespan Research Institute, accessed June 2024

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science research and real-world application, accelerating clinical practice and trials. However, many establishments that brand themselves as longevity clinics focus primarily on general wellness or aesthetic services with little grounding in evidence-based healthspan science.

Defining and promoting a standardized framework and common language for longevity medicine with key stakeholders (including regulators) could help provide needed clarity between wellness-oriented offerings and interventions based on evidence.

— While this progress is meaningful, overall levels of activity and investment are low, reflecting the nascent character of healthspan science. Investment in healthspan-related biotech still trails other therapeutic areas, despite having a much larger associated burden of disease[29] (Exhibit 5).

Hypothetically, if healthspan science were a mature TA, investments could be 2.5 times larger than oncology in terms of potential addressable DALYs. This burgeoning market could represent a significant opportunity: If healthspan science–based drugs were as effective as drugs for other mature TAs, scaling revenues to the disease burden (DALYs, for instance) yields estimates between $120 billion and $500 billion[30] in addition to creating broader societal benefits by extending healthspan.

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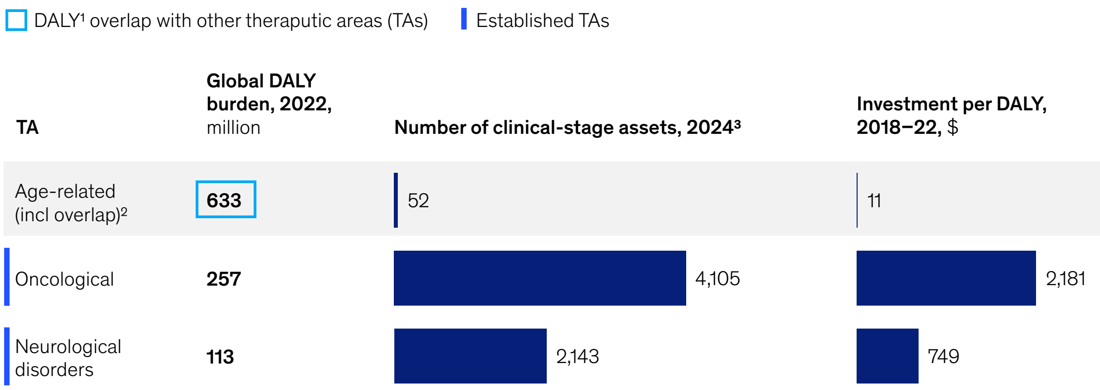
[29] American Medical Association; "Global Burden of Disease," Institute for Health Metrics and Evaluation, 2022; Angela Y. Chang, "Measuring population ageing: An analysis of the Global Burden of Disease Study 2017," *The Lancet Public Health*, March 2019, Volume 4, Number 3; McKinsey analysis of 2024 longevity and healthspan data from PitchBook.

[30] Illustrative estimate. Lower bound based on average of oncology, cardiology, respiratory, and central nervous system; upper bound based on oncology.

Exhibit 5

Investment in healthspan biotech is disproportionate to the burden of disease caused by age-related conditions.



[1]Disability-adjusted life years.
[2]Calculated by taking the DALYs of 92 age-related diseases outlined in 2019 Lancet paper with age groups <5 excluded (eg, maternal and neonatal disorders), then removing non-age-related DALYs attributed to environmental and occupational factors (eg, pollution, chemical exposure) and selected behavioral factors (eg, smoking, alcohol abuse), and finally removing remaining baseline DALYs not linked to aging (for ages <40).
[3]Includes launched clinical trials and trials in phases I–III.

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2 Seven shifts can help advance the field

Seven shifts could help mature the field of healthspan science, accelerating its progress and enabling it to live up to its promise.

1. Define the healthspan field and improve its perception

There is currently no consensus on how to define the healthspan field—or even what to call it. Renowned health institutions have created multiple definitions for related concepts. For example, the World Health Organization (WHO) refers to the field as "healthy aging" and defines it as "the process of developing and maintaining the functional ability that enables well-being in older age."[31] The Healthy Longevity Medicine Society refers to "healthy longevity medicine" as the evidence-based clinical discipline focused on optimizing healthspan by targeting age-related processes, integrating geroscience and prevention. The Longevity Biotech Association refers to it as "geroscience" and defines it as "the development of new medicines and therapies to prevent and cure, rather than merely manage, the health conditions of late life." And AFAR refers to it as "longevity dividend" and defines it as targeting the biology of aging to delay age-related disease.[32]

The difficulty of achieving conceptual clarity lies in the complexities of aging and the application of different terms across populations and contexts. Efforts are underway to harmonize terms and dimensions to guide research and inform policies.[33] These efforts are even outlined as WHO priorities.[34]

Beyond the conceptual underpinnings of healthy longevity and healthspan, there is potential to shift public discourse from a focus on lifespan to one on healthspan. Currently, the use of "lifespan" and related terms overshadows "healthspan" by a factor of 10,000 in the literature,[35] even though about 50 percent of those years are lived in less than great health and about 12 percent are lived in poor health.[36] This highlights that there is still room to further align the discourse on longevity with a focus on quality of life.

Developing a clear definition of the healthspan science field could also support a public consensus on future goals for the field.

Stakeholders will need to align on the following:

— whether to focus on healthspan, lifespan, or both

— whether healthspan science should focus on functional health, health as the absence of disease, or both

— whether healthspan interventions should focus on prevention, treatment, or both

— what type of intervention—such as lifestyle or biomedical—should be prioritized

[31] *World report on ageing and health*, World Health Organization, 2015.
[32] "What is the longevity dividend?," American Federation for Aging Research, accessed August 19, 2025.
[33] Marilyne Menassa et al., "Concepts and definitions of healthy ageing: A systematic review and synthesis of theoretical models," *eClinicalMedicine*, February 2023, Volume 56; Tessa Pocock et al., "Diverse approaches to conceptualising positive ageing: A scoping review," *Kōtuitui: New Zealand Journal of Social Sciences Online*, 2023, Vulume 18, Number 1.
[34] *Decade of healthy ageing: Baseline report*, World Health Organization, January 14, 2021.
[35] MHI analysis based on historical popularity of the terms "longevity" and "lifespan" related to healthspan on Google Books, global, 1994–2022.
[36] *Adding years to life and life to years*, McKinsey Health Institute, March 29 2022.

— whether healthspan interventions should focus on physical health or include other dimensions (such as mental, social, and spiritual health)

In this report, "healthspan science" refers to the pursuit of extending the years a person lives in good health and improving a person's ability to function by targeting the underlying processes of aging through biological interventions, medical interventions, or both.

2. Improve data availability to advance a fundamental understanding of the field

Research into the biology of aging is gradually progressing, but accelerating this research further requires increased global coordination, better access to comprehensive data sets, and a more effective application of advanced analytic tools. Each part and function of a body ages in a different way and at a different speed, so understanding "aging" as a TA is much more complex than other TAs.[37] For healthspan science to be successful, researchers would want to consider distinct attributes of aging trajectories across individuals and across organs or systems within the same individual, as well as the effects healthspan therapies could have on these different parts. A coordinated global research agenda that focuses on the areas with the most potential could pave the way for innovative interventions that can elongate healthspan.

Regularly measuring 80 to 200-plus biomarkers every two to five years across diverse global populations and age ranges would provide invaluable contributions to research on aging[38] (Exhibit 6). Since multiple efforts are ongoing,[39] a standard for data collection, validation, and integration could be developed to link and consolidate existing and future data sets.

Collaboration across a broad array of stakeholders, including academia, governments, and pharmaceutical companies, on large data sets and shared AI or machine learning (ML) tools—where stakeholders have already pioneered these tools in the field[40]—could significantly advance healthspan science by increasing the volume of interconnected data and enabling systematic analysis. Major biobanks, such as the UK Biobank, and longitudinal aging studies, including Our Future Health and the German National Cohort, could play a pivotal role in ensuring robust data governance, scientific integrity, and the broad availability of data for diverse research efforts. For example, further study of sex-based differences is essential, because research indicates that ovaries play a role in aging.[41] A 2024 analysis found benefits in hormone replacement therapy for postmenopausal women, while the role of declining testosterone levels for men on health and lifespan is not completely clear.[42]

3. Establish a consensus on biomarkers to measure aging and healthspan

Clinically validated biomarkers that define healthspan and aging trajectories are essential to progress healthspan science. These biomarkers can help advance intervention trials and gain regulatory approval as surrogate endpoints, reducing trial size and duration. Biomarkers could be built into a composite score for healthspan, which would change in response to interventions, preceding clinical improvement.

[37] John Furber, "Systems biology of human aging - network model 2019," *Innovation in Aging*, November 2019, Volume 3, Number S1.
[38] Current efforts include Inspire T Cohort, Our Future Health, UK Biobank, CLSA, All of Us Biobank, China Kadoorie, FinnGenn, German National Cohort.
[39] Multiple efforts to collect longitudinal measurements were presented in the 2024 annual Biomarkers of Aging conference. See Erik Jacques et al., "Invigorating discovery and clinical translation of aging biomarkers," *Nature Aging*, April 2025, Volume 5, Number 4.
[40] Alex Zhavoronkov et al., "Artificial intelligence for aging and longevity research: Recent advances and perspectives," *Ageing Research Reviews*, January 2019, Volume 49.
[41] Morgan E. Levine et al., "Menopause accelerates biological aging," *PNAS*, 2016, Volume 113, Number 33.
[42] Yufan Liu and Chenglong Li, "Hormone therapy and biological aging in postmenopausal women," *JAMA Network Open*, 2024, Volume 7, Number 8; Justin M. Ketchem, Elizabeth J. Bowman, and Carlos M. Isales, "Male sex hormones, aging, and inflammation," *Biogerontology*, 2023, Volume 24.

Several coordinated efforts are underway to identify and validate biomarkers and endpoints that are relevant to aging. Notable initiatives include the Hevolution Alliance for Aging Biomarkers and the Biomarkers of Aging Consortium, which have set important foundations by promoting comprehensive longitudinal data collection and developing biomarkers across multiple domains—including molecular, physiological, and functional measures (through epigenetic clocks such as PhenoAge and GrimAge), inflammation-related composite biomarkers (iAGE, for example), and functional performance measures, such as maximal oxygen uptake and grip strength.[43] In addition, WHO proposed the intrinsic capacity framework as a measure of functional abilities that reflect healthy aging, including cognition, locomotion, sensory capability, vitality, and psychological well-being.[44] Quality-of-life endpoints, derived from validated patient-reported instruments, such as the SF-36, that quantify participants' physical, mental and social wellbeing-together with other patient reported outcomes (PRO) can be used to provide a holistic assessment of healthspan interventions at all ages and across trajectories.[45]

However, all of these efforts lack clinical and regulatory validation. Current biomarkers fall primarily into diagnostic or prognostic categories that measure how much a person has aged, but there is a gap between these categories[46] and functional measures that can serve as surrogate or clinical endpoints that change in response to interventions. Therefore, it is difficult to link biomarkers and endpoints to meaningful clinical outcomes, such as a person's resilience to infection.

Moving forward, efforts could focus on developing standardized, representative,[47] and predictive biomarkers, as well as surrogate and anchor endpoints in parallel. What is needed is to identify clinically meaningful outcomes that serve as a reference point for determining whether a new measure of intervention delivers real-world benefit. For example, time to recovery of physical function after an acute stressor such as surgery can serve as an anchor endpoint to validate whether a biological age marker meaningfully reflects healthspan improvements. Researchers could prioritize five to 15 measurable markers and potentially associate them with a composite score to track the aging processes. Stakeholders could proactively engage with regulators to develop such a score or the necessary endpoints. Since new and better biomarkers are frequently being reported, such scores could adapt and not be "ossified," because overly strict adherence to outdated biomarker scores could hinder progress. Stakeholders could also better coordinate data sharing and harmonize validation strategies. Recognizing that the biomarker field is developing rapidly, flexibility to enable changes in shared biomarker panels will be important to facilitate progress. This will require new methods for rapidly agreeing on updated biomarker panels (perhaps over and above a core subset of biomarkers that would remain more constant).

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[43] Chiara Herzog et al., "Biomarkers of aging–NIA Joint Symposium 2024: New insights into aging biomarkers," *Aging Cell*, 2025, Volume 24, Number 7.

[44] "Healthy ageing and functional ability," WHO, October 26, 2020.

[45] For example: Philipe de Souto Barreto et al., "Looking at frailty and intrinsic capacity through a geroscience lens: The ICFSR & Geroscience Task Force," *Nature Aging*, 2023, Volume 3, Number 12; Philipe de Souto Barreto et al., "Real-life intrinsic capacity screening data from the ICOPE-Care program," *Nature Aging*, 2024, Volume 4, Number 9.

[46] As defined by Biomarkers, EndpointS, and other Tools (BEST) guidelines developed by the US Food and Drug Administration and the National Institutes for Health.

[47] Including an equity dimension to limit biases on factors such as sex and ethnicity.

Exhibit 6

Several global studies seek to track the evolution of biomarkers to help deepen the understanding of age-related diseases.

Study name	Description	Number of participants, thousand	Number of biomarkers measured	Data types collected[2]
Inspire T Cohort	Toulouse-based study aiming to identify potential markers of aging and treat age-related diseases	~1	200+	8
Our Future Health	The UK's largest health research program, aiming to understand and prevent diseases and improve the health of future generations	5,000[1]	150	8
UK Biobank	UK biomedical database that collects a range of data to enhance understanding of disease and promote public health	500	150+	8
CLSA	Comprehensive study that examines aging and its impact on health, quality of life, and healthcare utilization among Canadians	50	100	7
ELSA	Tracks the health, social, and economic circumstances of older adults in England to further understanding of the aging process	12	80	5
All of Us Biobank	Initiative aimed at gathering diverse health data across the US to personalize healthcare and improve treatment outcomes	1,000[1]	120	7
China Kadoorie	Large prospective study collecting data from Chinese adults to investigate the causes of chronic diseases and inform public policy	>500	200+	5
FinnGen	Project that combines genomic data from Finnish biobanks with health records to understand the genetic basis of diseases	520,000[1]	100	4
German National Cohort	Comprehensive population study designed to assess health and disease in the German population	200	150	7

[1]Projected aim for total number of participants once enrollment has finished.
[2]Biological, clinical, imaging, cognitive and psychological, lifestyle, demographic, wearable, environmental.

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Exhibit 6 (continued)

Several global studies seek to track the evolution of biomarkers to help deepen the understanding of age-related diseases.

Study name	Participant diversity	Advanced technology used (eg, AI)	Follow-up-frequency	Access rights[3]
Inspire T Cohort	France: Ages 20–102	Yes	Every year	Not disclosed
Our Future Health	United Kingdom: Ages >18	Yes	Follow-up intended; frequency not specified	Registered researchers with UK General Data Protection Regulation training
UK Biobank	United Kingdom: Ages 40–69	Yes	Not specified	Research proposal must qualify as health-related public interest
CLSA	Canada: Ages 45–85	No	Every 3 years	Application detailing project, peer review, ethics approval
ELSA	United Kingdom: Ages >50	No	Every 2 years	Sensitive data via application through UK Data Service SecureLab
All of Us Biobank	United States: Ages >18	Yes	Not specified	Tiered access (public, registered, and controlled for genomic data)
China Kadoorie	China: Ages 30–79	Yes	Every 2–4 years	Researchers with track record from eligible institutions
FinnGen	Finland: No age limit	Yes	Not specified	Researchers from partner organizations following data security exam
German National Cohort	Germany: Ages 20–69	Yes	Every 4–5 years	Scientists from all German-speaking countries

[3]All data sets are accessible only via an application process, often requiring detailed research proposal and access fee. Study organizers retain intellectual property rights.

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4. Accelerate clinical development and translation

An approved clinical intervention on the market with proven healthspan benefits would be a great advance for the field. Three broad routes to develop healthspan pharmaceuticals are being explored:

— *Existing drugs and molecules*. This route involves repurposing assets developed for other diseases and TAs (including pipeline assets that are under development) to use for healthspan benefits.

— *New molecular entities, clinical interventions, or combinations for existing MOAs*. This route involves developing next-generation drugs, combining drugs with other existing MOAs, or conducting other clinical interventions to produce healthspan benefits.

— *New MOAs relevant to the healthspan*. This route involves identifying new targets and MOAs (based on hallmarks of aging, for example) and progressing from preclinical evidence to real-life effects.

When it comes to clinical development and translation, the healthspan field faces challenges. First, much of the preclinical aging research has not progressed to clinical development, and individuals have not been studied for extended periods, limiting the longitudinal data available to characterize the aging process. Second, clinical trials are often nonstandardized and underfunded, especially when subpopulations are being studied to form novel hypotheses. In addition, the field lacks a chartered regulatory path, so the current pipeline has focused on assets that align with existing TAs, even if healthspan benefits are investigated (Exhibit 7).

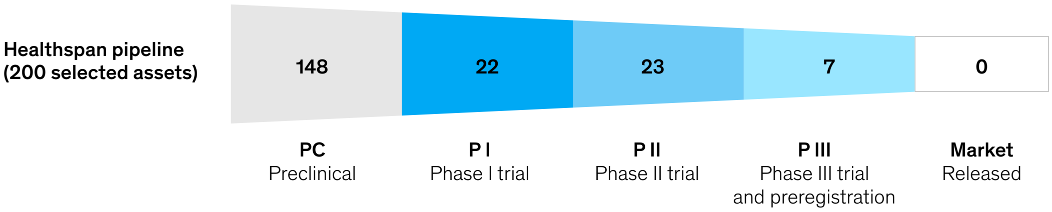
Broader use of innovative R&D tools based on short iterative loops can reduce risk, time, and cost in development—and also in healthspan science. Accelerating R&D on clinical interventions from lab to market requires advances in population understanding, target identification, candidate discovery, and lead optimization, as well as innovative clinical trial design and execution. More trials based on human data are needed, marking a shift from the traditional reliance on animal models; these efforts can integrate data into multimodal knowledge graphs, incorporate AI-driven iterative testing systems, and use adaptive trial design. Collaborations among biotechnology, pharmaceutical, and tech companies could help unite clinical-development expertise and advanced R&D approaches, particularly AI-driven ones. These collaborations could help expand the pipeline and deliver effective tools to extend healthspan.

Focusing on approaches within the following four areas can help accelerate healthspan clinical development and translation.

Exhibit 7

Healthspan-related therapies often fail to make it to market.

Distribution of selected active assets



Source: Pharmaprojects; "The Rejuvenation Roadmap," Lifespan Research Institute, July 2024 data (numbers are an estimation only). Assets selected based on explicit healthspan focus of the company, asset, or explicit focus of the mechanisms of action on a hallmark of aging with potential beyond currently pursued indication

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Broader use of innovative R&D tools based on short iterative loops can reduce risk, time, and cost in development—and also in healthspan science.

Population understanding
Aging is biologically heterogenous, so it is unclear why some people are considered clinically older or younger than their actual age. Gaining insights into the target population can help guide the development of a therapeutic intervention.

There may be opportunity to integrate data sets (genetic, phenotypic, and environmental, for example) to develop biomarkers that help deepen the understanding of aging cohorts and target appropriate interventions. Three approaches would be most beneficial in this area:

1. *More-extensive gathering of human data*. More data could be gathered from biological sampling and the use of biopsies and liquid samples. Results from these tests can be linked with phenotypic data, electronic health records, and digital biomarkers (such as wearables) to fill knowledge gaps on how people age. These biospecimens can be banked and shared with basic biologists investigating fundamental aging mechanisms.

2. *Merging diverse and scattered data sets*. Merging disparate data sets can help standardize data and improve access to it across institutions. Researchers could use AI to arrange and classify data based on aging phenotypes, genetics, lifestyle, and biomarkers.

3. *Agreement on core biomarkers and composite scores*. Integrating and analyzing data across different biological systems (or multiomics), using patient-reported outcomes, and applying AI to sort data can support biomarker discovery.

Target identification
Target identification involves finding the molecular mechanisms that are involved in a disease and learning how they could be influenced to prevent or treat a condition. For example, in type 2 diabetes, the enzyme dipeptidyl peptidase-4 (DPP-4), which breaks down incretin hormones that help regulate insulin secretion, has been identified as a key target. By targeting DPP-4 with drugs such as sitagliptin, researchers aim to manage the progression of diabetes.

Aging affects all organ systems and is likely to involve multiple targets or pathways simultaneously. Technology-driven approaches—such as digital twins, knowledge graphs on large data sets, and foundational models—can help identify molecular mechanisms to target.

Two approaches are most useful here:

1. *Multimodal biomedical knowledge graphs (BKGs).* Multimodal BKGs that integrate data sources—such as proteins, genes, pathway networks, and randomized controlled trial (RCT) outcomes—can simulate scenarios and identify potential targets.

2. *Using multiomics and systems biology*. Approaches such as multiomics and systems biology—which studies how parts of the biological system interact and function together—can help capture the complexity of aging pathways and identify multiple potential targets by analyzing their interconnected effects.

Candidate discovery and lead optimization
Animal model results on aging have been particularly difficult to translate because slowing or reversing a natural process is complex and aging is not linear. As the aging process is studied in more humans, it will be important to develop an optimized, iterative process to find and refine a more extensive sample of potential therapeutic candidates that interact with an identified target. Researchers can also consider using multicellular structures and models that mimic human biological processes—for instance, human organoids and in-silico models—to better predict clinical outcomes.

Two approaches are most useful here:

1. *AI-driven algorithms*. A more-automatic testing system can help develop drug candidates and optimize interventions to be useful in more than one context. Predictive analytics can help accelerate the indication selection and optimization process, enabling real-time adjustments.

2. *Optimizing wet labs*. Wet labs can use model-based hypotheses of identified leads and iterative closed-loop systems to continuously improve tests. They can also integrate new preclinical models—such as humanized animal models (killifish, for example) and organ-on-a-chip technologies—to more closely mimic human aging processes, improve translation, and support cost-effective trials before testing on human subjects.

Clinical trial design and execution
Because aging inherently involves long timelines and multiple endpoints, trials that test clinical interventions' safety and effectiveness are complex, lengthy, and expensive. Trial design can be optimized by leveraging advanced technologies to measure predictive endpoints and better identify and generate evidence in clinical research.

Three approaches are most helpful in this area:

1. *Adaptive trial design*. Trials can be designed to allow researchers to conduct an interim analysis, adjust an endpoint, and change the types, timing, doses, and combinations of interventions. These steps can help determine the efficacy of an intervention earlier and provide early data-driven simulations of trial outcomes using machine learning.

2. *Signal-seeking trials*. These smaller, exploratory studies can help researchers detect early signs of efficacy in aging-related conditions across populations while minimizing risk. These exploratory outcomes would next be tested in larger, prospective, more-focused trials.

3. *Practical, patient-centered endpoints for payers and regulators*. Endpoints such as post-surgery recovery, flu resilience, and intrinsic capacity can help payers and regulators evaluate intervention approvals and reimbursement processes.

5. Build aligned regulatory frameworks and processes

Established regulatory pathways could have a positive impact on long-term research and help derisk investments in healthspan science. Given the early stage of the pipeline, there are currently no widely established regulatory reference cases for healthspan drugs or interventions that target aging pathways to improve or maintain a person's healthspan. An aligned regulatory framework could encourage and support investment in this field.

Trial designs for regulatory approval of healthspan interventions are being explored, including a multicenter platform trial in which multiple treatments of diseases are evaluated under a master protocol.[48]

Another path forward may involve aligning aging research with established therapeutic areas, such as cardiovascular disease, immunology, neurology, or oncology, to allow clinical developers to use existing frameworks and generate evidence within familiar disease models before exploring broader aging-specific applications.[49] Alternatively, a regulatory focus could use novel pathways with new endpoints—for example, based on intrinsic capacity or other practical measures, such as infection resilience—to approve an intervention for use across a range of diseases and indications.

The role of regulators with respect to nonmedical interventions is another interesting area for exploration, albeit beyond the scope of this report since these are not biomedical interventions. For example, some supplements have higher levels of evidence requirements.[50] The regulatory functions of nonmedical interventions may be applicable when building out a regulatory pathway for biomedical interventions, because the healthy-longevity market is currently behaving as a consumer market thanks to high consumer demand for products such as supplements and wearables.

6. Derisk investment

Currently, the healthspan science field predominantly attracts high-risk investors, such as venture capitalists and high-net-worth individuals (HNWIs), who together account for about 60 percent of funding. In comparison, these investors account for less than 15 percent of funding in oncology (Exhibit 8).

These investors have a higher risk appetite but may have less specific expertise to guide biotech in its development journey, especially in the case of more generalist VCs. In contrast, pharmaceutical companies and traditional life sciences (LS) investors contribute to only 40 percent of the funding, likely because regulatory and commercial pathways and issues regarding intellectual property protection are unclear. By comparison, in more-established therapeutic areas, such as oncology pharmaceutical companies, and traditional LS investors account for almost 90 percent of investment.

Going forward, multiple approaches could help derisk and encourage investment. For example, new investment models—such as blended finance from philanthropy, healthspan science–focused VCs, and HNWIs—can co-invest with established entities, including pharmaceutical companies and blue-chip investors, in some settings. This approach combines the best of the medical and translational expertise of pharmaceutical companies with the investment acumen and larger fund volumes of blue-chip venture capitalists, potentially enabling more at-scale, long-term investments.

48 Guido Kroemer et al., "From geroscience to precision geromedicine: Understanding and managing aging," *Cell*, 2025, Volume 188, Number 8.
49 Banking and distributing samples from these trials to the basic biology of aging research community could enable "reverse translation" from bedside to bench, accelerating discovery of new gerotherapeutic targets and interventions.
50 "Label claims for conventional food and dietary supplements," US Food and Drug Administration, current as of March 28, 2024.

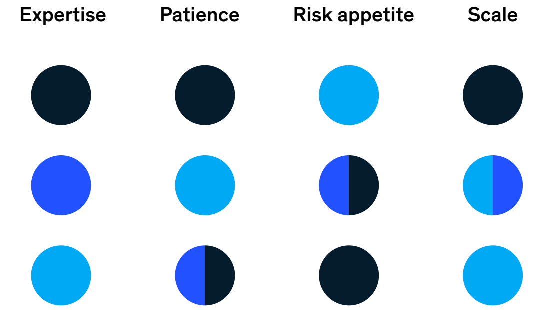
Exhibit 8

Pharmaceutical companies and venture capital have led investment in healthspan science, although at a limited level.

Cumulative investment in biotechs,[1] 2000–24, $ billion

Strength of investor: High ● ● ● Low

Investor	Oncology	Healthspan science
Pharmaceutical companies and industry funding	~87%	~41%
Venture capital	~13%	~47%
HNWI[2] (excl through VC)	<0.1%	~12%



Note: Government funding is not represented because it is primarily directed to research institutions and not biotech. Figures may not sum to 100%, because of rounding.
[1]Total financing is ~$27 billion, but only ~$20 billion has disclosed investors.
[2]High-net-worth individuals. Figures are likely higher—every deal is proportioned out equally by number of investors, so figures may not capture instances in which HNWIs have contributed the majority to a deal; eg, they likely underestimate the amount contributed by Jeff Bezos and Yuri Milner to the $3 billion Altos Labs deal.
Source: PitchBook deal analysis 2000–24

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7. Educate practitioners and encourage them to advance the field

A shift of focus from "sick care" to "health care" is at the core of healthspan science's promise of healthy longevity. Practitioners, including clinical researchers, are trained to respond to disease; they are neither trained nor encouraged to address or research age-related health conditions before they manifest. Creating incentives for more practitioners to engage in the field and drive innovation and maturity could significantly accelerate progress. Such efforts would advance research, development, and clinical applications, ultimately contributing to a more proactive approach in managing healthspan and enhancing overall quality of life.

Increasing the use of scientific data and enhancing collaborations between practitioners and academia in partnership with pharmaceutical companies could accelerate development in the field significantly. For example, the Institute for Healthier Living Abu Dhabi, the world's first regulated healthy longevity medicine center, partners with the Healthy Longevity Medicine Society with the goal of improving standards globally in the healthspan field across diagnostic and interventional services.[51]

Incentives and support structures could be explored to achieve better healthspan and quality-of-life outcomes, and educational and career pathways could help increase overall awareness. For example, Singapore's Healthier SG subsidizes free prevention services to boost adoption and reduce the burden on the healthcare system.[52]

[51] "Department of Health – Abu Dhabi licenses Institute for Healthier Living Abu Dhabi as world's first specialised healthy longevity medicine centre," Emirates News Agency, November 19, 2024.
[52] "Benefits of Healthier SG," Healthier SG, accessed August 19, 2025.

A word of caution in the midst of some people's enthusiasm for healthspan science

While biomedical innovation holds promise, investments should not come at the expense of improving and scaling proven interventions. Interventions and behaviors based on healthspan drivers such as sleep, nutrition, physical activity, social interaction, or stress management are backed by evidence, and there is a lot of value in scaling them.[53] The development of new tools and the related evidence should be pursued in parallel to harnessing the benefits of what we already know to be effective. Healthspan science is thus an opportunity to reinforce a prevention approach to healthy longevity, building on existing tools and practices to make societies more effective at addressing health ahead of disease.

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[53] Jun Wang et al., "Healthy lifestyle in late-life, longevity genes, and life expectancy among older adults: A 20-year, population-based, prospective cohort study," *The Lancet Healthy Longevity*, October 2023, Volume 4, Number 10; Yves Rolland et al., "Challenges in developing Geroscience trials," *Nature Communications*, 2023, Volume 14, Number 5038.

A shift of focus from 'sick care' to 'health care' is at the core of healthspan science's promise of healthy longevity.

3 Broad stakeholder involvement could accelerate progress toward enhanced healthspan for all

The emerging field of healthspan science holds great potential for population health and the economy globally. Stakeholders can play a role in furthering the field, aligning their interests and strengths with various investment opportunities. Expectations vary about when a clinical intervention that meaningfully intervenes in the biological process of aging is likely to come to market. At the same time, there is a clear sense of potential driven by gradual scientific advancements and substantial latent demand for new tools. Stakeholders can work individually and together to accelerate the maturity of the field and to work toward realizing its potential.

Academia

Academia is at the forefront of healthspan science. Prominent scientists from renowned academic institutions carry the field forward in the public arena and help shape industry and policy. Leaders in academia have a crucial role in advancing the field scientifically, but they can also indirectly derisk investment in the field and inform broader innovation activity in the healthspan space. Potential actions include the following:

Align research agendas globally. Stakeholders in academia can contribute research and expand the field by prioritizing efforts based on their outcome potential and aligning these priorities with peers globally.

Increase cross-pollination across disciplines by defining and using clear standards. Standardizing activities in the healthspan field—for example, by using a flexible but aligned set of biomarkers across research programs (doing so in a manner that takes account of the rapid discovery of new biomarkers)—ensures that insights and results can be more easily shared across stakeholders.

Increase collaboration to create large data sets and share AI and ML tools. Stakeholders in academia can increase the volume of connected longitudinal data available to enrich hypothesis generation and validation opportunities.

Biotechnology companies

Biotechnology companies are a core innovation engine of healthspan science, owning more than 90 percent of phase 1 and 2 assets in healthspan science.[54] These stakeholders are agile enough to adapt quickly and be innovative in early and emerging areas. Healthspan science interventions have potential for not only great health impact but also significant financial upside, given the hypothesis of applicability across multiple major TAs.

Stakeholders in biotech can take the following actions to advance the field:

Embed existing regulatory and commercialization models into research. By aligning with existing regulatory and commercialization models from the outset, biotech companies can better ensure that the business case resonates with blue-chip investors as it scales. They can also learn from other TAs that have more robust commercialization expertise.

Seek more collaborative financing set-ups. Partnerships with HNWIs, philanthropic funds, and standard life sciences investors can open more avenues for funding.

[54] McKinsey analysis of 2024 longevity and healthspan data from PitchBook.

Actively seek collaborations with other biotech companies and ecosystem partners. Collaborating with other companies on pre-competitive activities, such as data infrastructure and specimen archiving, can help build out the field. No biotech has the scale to develop these areas alone.

Pharmaceutical and medtech companies

Healthspan science can open new avenues for clinical development across TAs. Even limited participation from pharmaceutical companies in healthspan science could be beneficial for the field and create value for companies: A breakthrough in the field could be disruptive in the same way GLP-1s are for treating obesity.

Stakeholders in the pharmaceutical and medtech sector can advance healthspan science through the following actions:

Assess the strategic relevance of healthspan science for current and future portfolios. Pharmaceutical and medtech companies can review their current pipelines and future strategies to identify opportunities and disruptive potential related to healthspan science.

Consider bespoke investment in the field. Opportunities could include making modest investments to help shape healthspan science, expanding in-house R&D or engaging in more research collaborations with academia, pursuing blended finance models with HNWIs or philanthropists, in-licensing, and asset acquisition.

Collaborate with others to shape the field. Collaborating on pre-competitive activities, such as sharing data and participating in the establishment and evolution of biomarkers, can support further discovery.

Clinicians and health systems

Health systems and other care delivery organizations can incorporate healthspan science into their preventive-care agendas across patient pathways. This could provide clinicians with additional tools to help their patients before age-related diseases occur.

Healthy longevity clinics grounded in evidence are already developing, and there are opportunities to provide innovative care to patients. However, this area is still nascent, making it difficult to differentiate clinics that focus on wellness from those that use evidence-based medical practices.

Clinicians and health systems could take the following actions to advance the field:

Develop and adopt evidence-based standards for healthy longevity medicine in collaboration with regulators, academia, and pharmaceutical companies. Setting clear standards across stakeholders, with the help of professional societies in the field, can help clearly differentiate healthy longevity medicines and clinics from wellness-focused solutions across geographies and contexts.

Train physicians to incorporate elements of healthy longevity medicine into their practice. Physicians can incorporate evidence-based assessments—such as functional mobility screening as part of a comprehensive health assessment—into their practices to expand public awareness of aging-related diseases and enable preventive measures. These efforts could be especially helpful in settings that promote wider access, such as publicly funded hospitals and primary care clinics.

Collaborate on clinical trials. Frontline clinicians, such as geriatricians or emergency medicine doctors, can then go on to play a leading role in trial design, recruitment, and implementation.[55]

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[55] Different perspectives exist on which discipline would be best to own this responsibility.

Blue-chip investors
Healthspan science presents investors with a significant opportunity in both the pharmaceutical and consumer markets. A report in *Nature* shows that the economic value of adding one year of healthy life to everyone in the United States could be as much as $38 trillion, and the value from an additional ten years could be as much as $367 trillion.[56] Collaboration or concerted action from blue-chip investors to advance the healthspan field could help derisk investment and provide a larger scale of resources from a wider variety of investors.

Potential actions blue-chip investors can take to advance the field include the following:

Engage with the field and build internal expertise. Building healthspan expertise can help investors identify areas of opportunity and potentially create portfolio value in the future. For example, strategic investment in clinical trial infrastructure, such as healthspan-focused research centers, or in diagnostic capabilities such as biomarker labs can help accelerate development of healthspan products, spanning both consumer health products and pharmaceuticals.

Explore options to reduce investment risk. Collaboration or blended finance models with philanthropic institutions, HNWIs, pharmaceutical companies, and governments can help reduce the risks of investing in this emerging field.

Help shape the direction of the field. Blue-chip investors can help build the field by steering early innovators in an advisory capacity toward viable business models.

[56] Andrew Scott, Martin Ellison, and David Sinclair, "The economic value of targeting aging," *Nature Aging*, 2021, Volume 1. Calculations are made based on willingness to pay, which takes into account the value of each remaining year of life, including quality of life (for example, health, consumption, and leisure), and survival rate (to discount to present-day considerations).

Collaboration or concerted action from blue-chip investors to advance the healthspan field could help derisk investment.

The public sector
Societies benefit significantly from wider access to healthspan science initiatives that enhance population health and reduce social care and healthcare costs. Societies currently face challenges with aging populations and decreasing dependency ratios,[57] which strain social security models. Both challenges can be addressed by targeting healthspan. The public sector has an opportunity to ensure that public health is at the center of healthspan intervention developments and to determine its broader role in guiding and scaling these efforts.

Public sector stakeholders can consider taking the following actions to advance the field:

Prioritize funding for research into the biology of aging. By reserving funds for specific causes (for example, grants to complete a global aging observational study), investing in relevant infrastructure (such as data infrastructure that connects current real-world aging data), and creating incentives through policy for R&D (which has been done in fields such as rare diseases) public sector stakeholders can bring healthspan-related studies to the forefront and advance the field.

Collaborate across international research organizations. Through collaborations, stakeholders can cross-pollinate research, facilitate access to data, and standardize relevant parameters. For example, funding packages could include a requirement for researchers to measure certain aligned biomarkers, or they could require teams to establish data and sample repositories that other entities can use for reverse translation.

Engage in early-stage regulatory discussions. Public sector stakeholders can support innovation by outlining appropriate research pathways based on the public interest and by providing a stable, transparent regulatory environment to foster long-term investment from the private sector.

Payers
Payers, especially those who treat populations over a long time frame, have an opportunity to support initiatives that extend healthspan and prevent disease. These interventions have the potential to lower healthcare costs by reducing the burden of age-related diseases, which aligns with payers' goal of improving the quality and cost-effectiveness of healthcare. Importantly, the potential of interventions targeting fundamental aging mechanisms to treat or reverse disorders and diseases that have, until now, been difficult to manage—for example, dementias and other neurological conditions, many cancers, long-term post-infectious syndromes, and multiple musculoskeletal diseases—could reduce costs substantially.

Payers can take a variety of actions to advance the field, including the following:

Prepare for a future that could include healthspan interventions and drugs. Payers can create innovative models that incorporate relevant preventive measures and health promotion to support healthcare providers in scaling healthspan interventions.

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[57] "Dependency and depopulation? Confronting the consequences of a new demographic reality," McKinsey Global Institute, January 15, 2025.

Develop new business models. Payers could more closely align long-term health outcomes with payer incentives, potentially exploring solutions in collaboration with governments.

Consumers and the public

Individuals are paying more attention to their health and taking more ownership over it—both in healthcare settings and more broadly as consumers. Consumer demand is rising for health-oriented products such as healthy foods and heath-focused consumer electronics. The current market for healthspan-related products is dominated by supplements and wearables because no approved clinical intervention yet exists.

Consumers can take the following actions to advance the field:

Provide access to data to facilitate innovation. Health-forward individuals who are trying to optimize their health through supplements and nutrition may allow researchers to access their anonymized data for intervention research. Other stakeholders could explore incentive models for this data, including allowing individuals to maintain ownership over their data even if they share it for commercial use.

Shape the healthspan market through appropriate channels. Consumers can raise “healthspan” as a civil society topic—for example, through dedicated advocacy with governments and stakeholders.

Technology companies

It’s increasingly clear that AI and data will play a critical role in our understanding of aging and the development of interventions.[58] Tech companies looking at health as a growth market can strategically invest and partner with other stakeholders to be at the center of developing widely accessible healthspan interventions.

Technology companies can take a variety of actions to advance the field, including the following:

Prioritize decoding aging biology as an AI use case. Tech companies can develop bespoke AI models that help decode and generate healthspan-related data. They can also give researchers access to large volumes of data and formidable computing capabilities.

Consider partnerships with biotech companies. The use of AI and ML tools is likely to be higher in healthspan research than in other TAs because of the complexity of the field. Tech companies can partner with biotech companies to leverage these technologies for research and development of healthspan interventions.

Philanthropists and high-net-worth individuals

Funding healthspan science is an opportunity to create lasting health and economic impact by increasing the healthspan of individuals globally. Many philanthropic organizations, such as the Hevolution Foundation, and HNWIs are already active in the field, directly funding 12 percent of biotech investments in healthspan science and likely many more through VCs. In contrast, philanthropic organizations and HNWIs fund less than 0.1 percent of investments in oncology. These stakeholders play a critical role in the healthspan field because they can take financial risks to advance innovation.

[58] “AI in biopharma research: A time to focus and scale,” McKinsey, October 10, 2022.

Potential actions philanthropists and HNWIs can take to advance the field include the following:

Fund blended finance models. By engaging with life sciences investors and other stakeholders, philanthropists and HNWIs can help attract other funding while taking on most of the risk. In partnership with life sciences investors, they can support clinical development focused on healthspan science through signal-seeking trials.

Be creative to catalyze cross-sector action to advance the field. The field holds great promise, but the actions needed across stakeholders are daunting. Philanthropists and HNWIs have the independence to play ecosystem-building roles that other stakeholders may find difficult. They could create and nurture an alliance to accelerate progress on the topic on a global scale.

Where stakeholders can begin

A successful healthspan field would have clear benefits for all stakeholders involved, and each stakeholder brings a set of capabilities and expertise that can help make the promise of healthy longevity a reality. It will be important to foster collaboration among healthspan stakeholders wherever appropriate given that the field is still at an early stage and needs to mature.

As a first step, four areas could be tackled collaboratively, potentially under the umbrella of an acceleration coalition. Core pillars of a cross-sector coalition could include the following:

— a global data collaboration that develops and connects data sets to establish fit-for-purpose endpoints that will enable regulatory approval for healthspan interventions

— signal-seeking trials on the best candidate interventions to validate the geroscience hypothesis, with fit-for-purpose design (for example, on multimorbid populations) to derisk investment and enable further trials based on the results; this could also be the basis for a clinical trial infrastructure for healthspan science to lower costs and accelerate clinical development

— blended finance to scale investment in healthspan science by improving risk profiles for key investors (such as pharmaceutical companies and blue-chip VCs)

— structuring the field by defining and aligning medical and public health frameworks based on evidence (for example, appropriate interventions, target outcomes, guidelines, and evidence levels), allowing for greater transparency and informing investment choices

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Concerted action and coalitions across sectors are likely the most effective way to advance healthspan science. This entails bringing together mainstream life sciences investors, governments, research funders, media outlets, ethicists, and the public to better understand the field and realize the concrete benefits of investing in healthspan science. The McKinsey Health Institute is excited to engage in debates on the themes in this report. Moving forward, all stakeholders have roles to play, and in turn all stand to benefit from advances in healthspan science.

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Glossary

Term	Explanation
Biomarker	A measurable indicator of a biological state, such as the presence or progression of a disease or a response to a treatment
Biomedicine	A branch of medical science that applies principles from biology, physiology, and molecular science to understand, diagnose, and treat human diseases
Biotechnology	A multidisciplinary field that uses living organisms and their components to develop products and services
Digital twin	A real-time virtual replica of a physical object or system used for monitoring, analysis, and simulation
Disease burden	Disability-adjusted life years lost attributable to certain diseases or risk factors
Endpoint	An event or outcome that can be measured objectively to determine whether the intervention being studied is beneficial
Foundation model	A large, general-purpose AI model trained on broad data and adaptable to many specific tasks
Geroscience	An interdisciplinary field that seeks to understand the biological mechanisms of aging and how they contribute to age-related diseases. Its central premise (geroscience hypothesis) is that therapeutically addressing aging biology can prevent or delay the onset of age-related diseases, mitigate their severity, or even treat and reverse them
Hallmarks of aging	A set of cellular and molecular changes that contribute to the process of biological aging
Healthspan	Number of years that a person lives in good or great health and free of significant illness or disease
Healthy longevity	The ability to live longer while maintaining good physical, cognitive, and emotional health—essentially, extending healthspan, not just lifespan
Intrinsic capacity	Introduced by the World Health Organization and defined as "the composite of all the physical and mental capacities that an individual can draw on at any point in time"; intrinsic capacity encompasses five key domains[59]:
	1. Cognition: Assessed using tools such as the Mini-Mental State Examination
	2. Locomotion (mobility): Evaluated through tests such as the Short Physical Performance Battery
	3. Vitality (energy balance): Often measured by nutritional assessments including the Mini Nutritional Assessment
	4. Psychological: Assessed using scales such as the Geriatric Depression Scale
	5. Sensory (vision and hearing): Evaluated through standard sensory function tests

[59] See Médéa Locquet et al., "Intrinsic capacity defined using four domains and mortality risk: A 5-year follow-up of the SarcoPhAge cohort," *The Journal of Nutrition*, Health and Aging, January 2022, Volume 26, Number 1.

Knowledge graph	A structured network of entities and their relationships that helps organize and interpret data meaningfully
Multimodal data	Information that combines different types of data or sensory inputs, such as text, images, video, and audio, for a more comprehensive understanding
Multiomics data	The integration of data from multiple “omics” disciplines, such as genomics, transcriptomics, proteomics, and metabolomics, to gain a more comprehensive understanding of biological systems
Phenotypic data	All kinds of clinical information regarding patients’ disease symptoms, as well as relevant demographic data, such as age, ethnicity, and sex
Preventive lifestyle	A proactive approach to health that focuses on reducing the risk of disease and promoting long-term well-being through regular habits and behaviors
Public health	The science and art of preventing disease, prolonging life, and promoting health on a population level through organized efforts and informed choices of society, organizations, and individuals

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