

The image features four hourglasses arranged in a 2x2 grid. The top-left hourglass has blue sand and a blue DNA double helix structure. The top-right hourglass has black sand and a black silhouette of the Statue of Liberty. The bottom-left hourglass has blue sand and a blue silhouette of the Statue of Liberty. The bottom-right hourglass has black sand and a thin stream of black sand falling from its neck. The background is a light gray with a hexagonal pattern and faint wireframe structures.

# *Metabesity and Longevity* USA Special Case Study

Analysis and Policy Implications

**HIGHLIGHTS FROM REPORT**



TARGETING METABESITY 2019

15-16 October 2019 | Washington, DC, USA

[www.metabesity2019.com](http://www.metabesity2019.com)



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# United States: Metabesity and Longevity

## Analysis and Policy Implications

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## Contributors to the Report



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**Kate Batz** is a Managing Partner of Longevity.Capital and Director of Strategy and Business Development at Deep Knowledge Ventures and Aging Analytics Agency, supervising activities in the United States. She is an experienced corporate attorney licensed to practice law in California and New York, with an extensive sales and marketing background. At the beginning of her career, Kate was involved with international litigation when she worked for a former Pennsylvania state senator. As a corporate attorney, Kate worked with several Fortune 500 clients. Compelled by the paradigm-shifting advances in science and technology in the fields of aging and longevity, Kate enthusiastically joined Deep Knowledge Ventures Group.

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**Franco Cortese** is Deputy Director of Aging Analytics Agency. He has co-authored of over a dozen scientific papers on the topics of longevity, ageing and biogerontology in peer-reviewed journals including Scientific Reports (Nature Publishing Group), Journal of Gerontology Series A (Oxford Academic), Frontiers in Genetics, Aging, Oncotarget and others. He was also part of the team behind the proposal that prompted the World Health Organization to add an extension code for “ageing related” (XT9T) during their ICD-11 revisions in 2018. He served as a Trustee of the Biogerontology Research Foundation during 2017, and as its Deputy Director from 2016 - 2018.

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**Breanna Deutsch** became passionate about the relationship between policy and longevity while working as a staffer on Capitol Hill in both the U.S. House of Representatives and the U.S. Senate. She believes that informing Congress and regulators about the importance of prioritizing longevity in healthcare policy is critical in creating a path for life-changing treatments to make their way through the regulatory system and into the hands of the public. Breanna received a B.A. in American Studies from Scripps College and a M.S. in corporate communications from Georgetown University.

## Contributors to the Report



**Dr. Alexander Fleming** is Founder and Executive Chairman of Kinexum. He is also Chief Medical Officer of Tolerion. Dr. Fleming's regulatory and technical expertise has been requested in numerous international settings. At the US Food and Drug Administration from 1986 to 1998, Dr. Fleming was responsible for the therapeutic areas of diabetes, other metabolic and endocrine disorders, growth and development, nutrition, lipid-lowering compounds, and reproductive indications. He was assigned from FDA to the World Health Organization from 1991-92. Dr. Fleming coined the term "metabesity," which refers to the constellation of cancer, cardiovascular and neurological diseases, diabetes, and the aging process itself, all of which share common metabolic root causes and potential preventive therapies.

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**Dr. Michael Zemel** is founder and CSO of NuSirt Biopharma. At NuSirt, he developed and ran the discovery R&D program in metabolic health, focused on energy-sensing and development of therapeutics for diseases of aging and over-nutrition, leading to clinical-stage asset development in obesity, diabetes, and NASH. Dr. Zemel is also a preclinical and clinical development, project management, and regulatory affairs consultant at Kinexum. Previously, Dr. Zemel was Professor of Nutrition and of Medicine at the University of Tennessee from 1990-2012, where his work focused on energy sensing, muscle-fat cross-talk, and regulation of adipocyte metabolism. Prior to the University of Tennessee, he served on the faculties of Endocrinology and of Nutrition at Wayne State University and as Research Endocrinologist at the VA Medical Center associated with Wayne State from 1980-1990. He founded NuSirt Biopharma in 2007.

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**Thomas Seoh** is President and CEO of Kinexum, a strategic advisory firm that provides regulatory, clinical, CMC, and other translational guidance for life science product development. He is an entrepreneur/executive who has held senior leadership positions in public and private pharmaceutical, biotech and medical device companies for over 25 years. Thomas subsequently served in leadership positions of medical device startups developing an ex vivo liver dialysis device, a novel mechanical thrombectomy device for Deep Vein Thrombosis and stroke and a state-of-the-art neurocatheter, and a plant-based skin substitute wound dressing. He has served on industry-university advisory boards at Johns Hopkins School of Medicine and the University of Maryland Baltimore County.

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# Overview

## I. Metabesity, Longevity and Health

Metabesity names the major chronic diseases, cancer and the aging process itself, all which share common metabolic roots and therefore can be collectively targeted. They comprise the most prevalent and costly degenerative conditions afflicting US citizens today. When metabolism is impaired or stressed, we age. Together with overnutrition and sedentary lifestyle, aging is a major risk factor for these diseases. Thus, the most effective and economic approaches to healthcare will necessarily involve the prevention of costly chronic diseases by intervening against their shared metabolic roots as early as possible, to prevent rather than to have to treat them.

## II. The GAP Between USA Health and Wealth: High Healthcare Expenditure, Low Health-Adjusted Life Expectancy (HALE)

Despite having one of the highest rates of healthcare spending, the United States is a complete outlier in terms of life expectancy at birth, Health-Adjusted Life Expectancy (“HALE”), and healthcare efficiency. Other developed countries are maintaining a much higher state of Healthy Longevity with much lower rates of healthcare spending. This is not due to inherent genetic differences - the USA is simply not implementing adequate policies and practices to utilize their healthcare dollars in effective ways.

## III. The Needed Shift from Sick Care to Preventive Medicine then Precision Health, then Economic Prosperity

As the population ages, sick care will become increasingly expensive and ineffective. The USA needs to rapidly implement a broad-based shift from treatment to population-wide prevention. An array of tools are available ranging from simple digital-supported education to precision health approaches, using deep diagnostics and prognostics in combination with biomarkers of aging. These tools can both reveal and confirm effective interventions and guide their optimal selection for the individual. The aim is to thereby delay the onset of disease with as minimal intervention as possible, as early as possible. Synergies of Longevity research, P4 medicine and Artificial Intelligence have the potential to enable rapid and widespread policy and infrastructural transformation of healthcare in America to quickly boost National Healthy Longevity (healthspan). However, this can only be possible with sufficient public and private commitment at every level and step.

## IV. Policy Implications: National Government Strategy to Narrow the GAP Between Life Expectancy and HALE

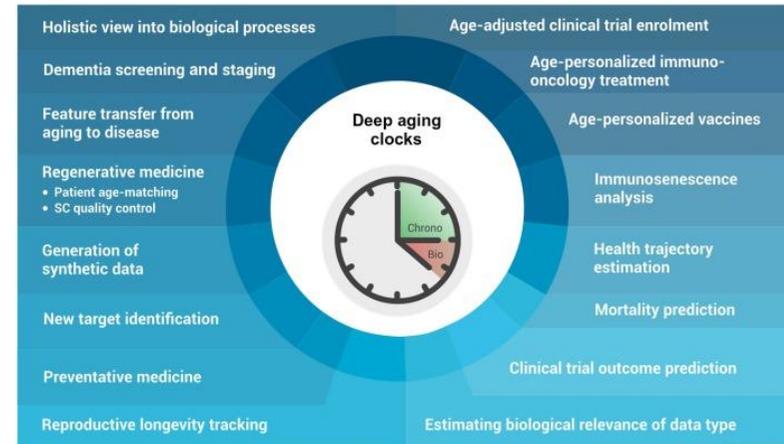
The United States holds the greatest share of the multi-trillion dollar global Longevity economy and the majority share of global Longevity Industry companies and players. It also has one of the highest rates of healthcare expenditures. While the US has all the resources necessary to become a global leader in Longevity, Preventive Medicine and Precision Health, and of National Healthy Longevity, it lacks such prioritization among government and private healthcare stakeholders. A cohesive strategy is lacking for enabling the Longevity Industry, AI, and Preventive Medicine to work in synergy, rather than in discoordination. The USA's low HALE and large gap between HALE and life expectancy is not for lacking scientific knowhow,. The need is for policies to apply the science.

## Accelerating the Development of Precision Health through AI



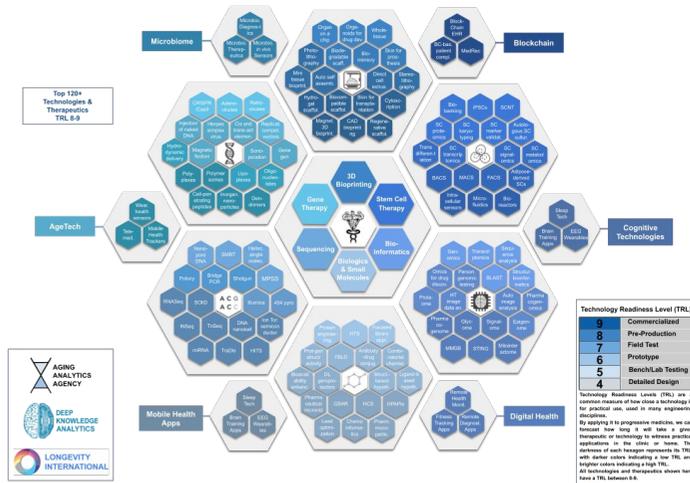
The intensive application of AI to all stages of longevity and preventive medicine R&D has the potential to rapidly accelerate the clinical translation of both validated and experimental diagnostics, prognostics and therapeutics, to empower patients to become the CEOs of their own health through continuous AI-driven monitoring of minor fluctuations in biomarkers, and to accelerate the rapid development of the global longevity industry to scale.

## Trends in Pharmacological Sciences



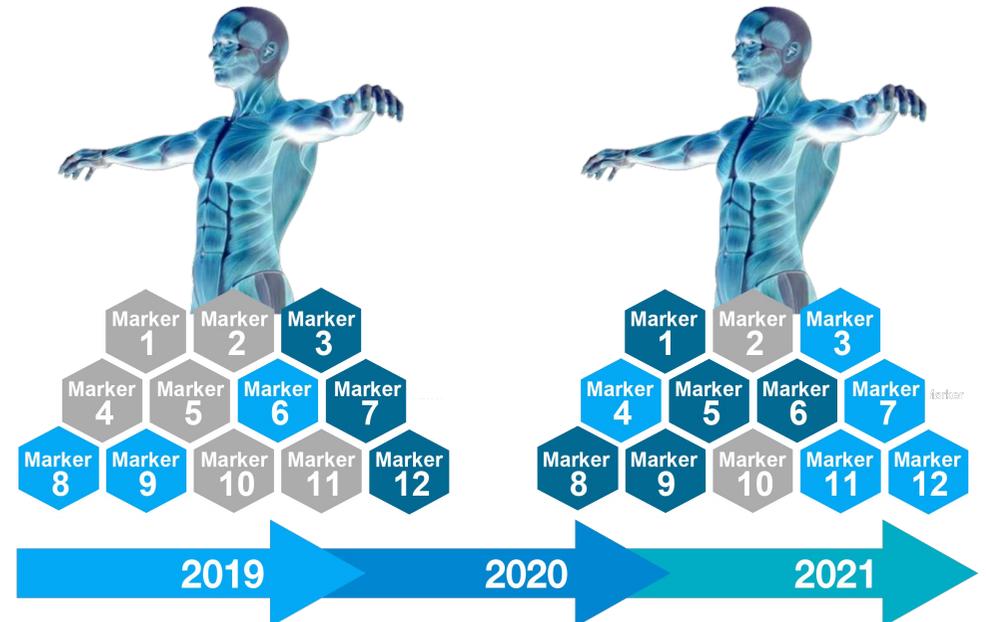
The ongoing shift toward diverse and actionable biomarkers of aging is described at length in [a recent scientific article](#) by Alex Zhavoronkov, CEO of Insilico Medicine.

## The Business of Progressive Medicine 2019: Practical Applications

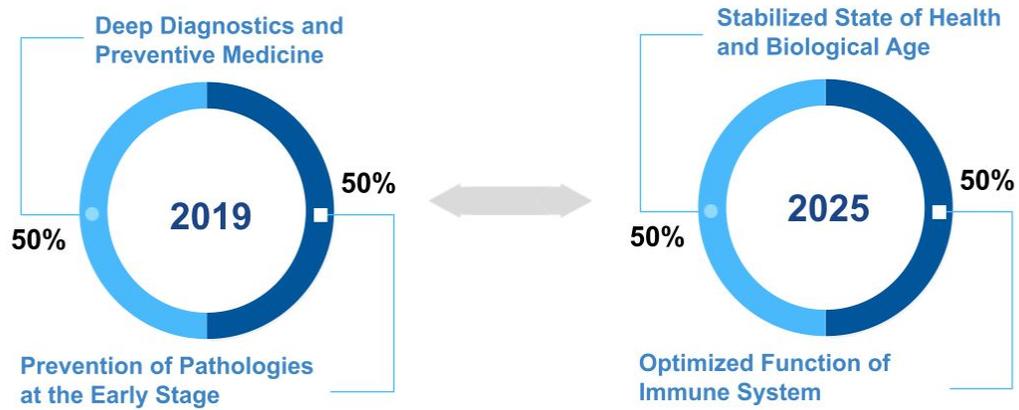


The quantitative and tangible assessment of technologies, methods, therapies and companies within the longevity space necessitates the use of novel approaches to technological, scientific and industry benchmarking, utilizing methodologies like Technology Readiness Levels (TRLs), which use the expertise of science and technology professionals to assess the market-readiness of products and services, and forecast when their clinical translation will become a reality.

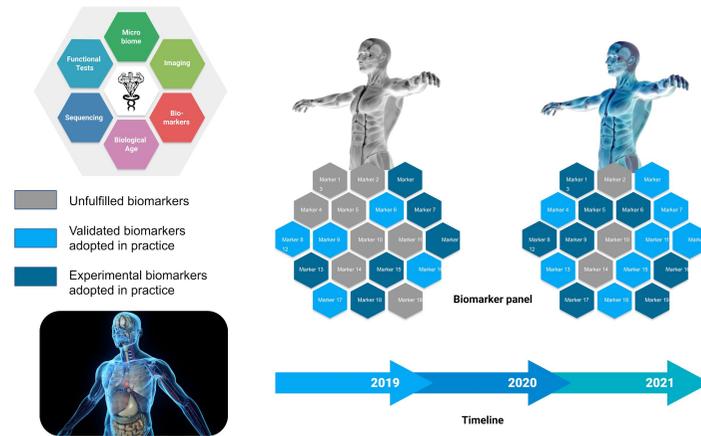
## Accelerating the Development of Precision Health through AI



## The New Frontier - from Precision Medicine to Precision Health



## Development of “Minimum Viable” and “Most Comprehensive” Panels of Biomarkers of Aging



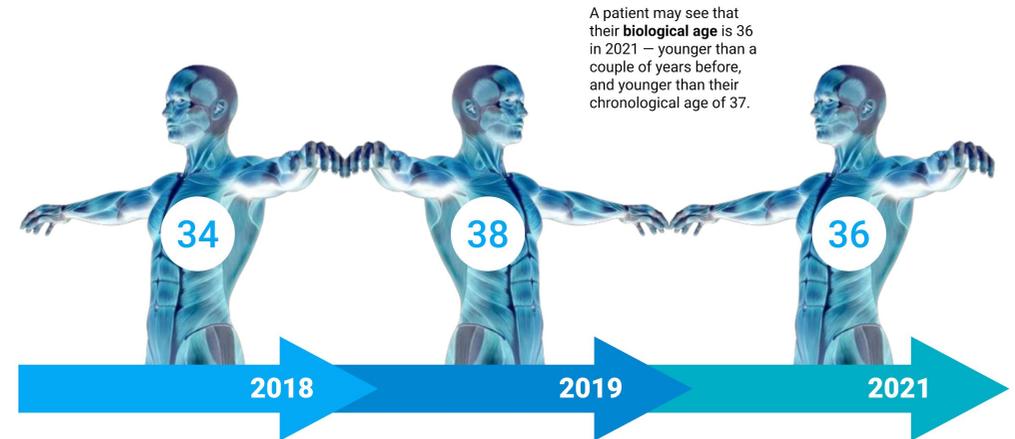
As the precision health industry is grown and developed to scale, we will see an increasing emphasis on the creation and validation of a wide diversity of biomarkers of aging come into use, which will enable the extension of healthspan and the maintenance of optimal health for the majority of citizens' lifespans via continuous, AI-empowered monitoring of fluctuations in personalized biomarkers of aging.

## Precision Diagnostics: New Intervention



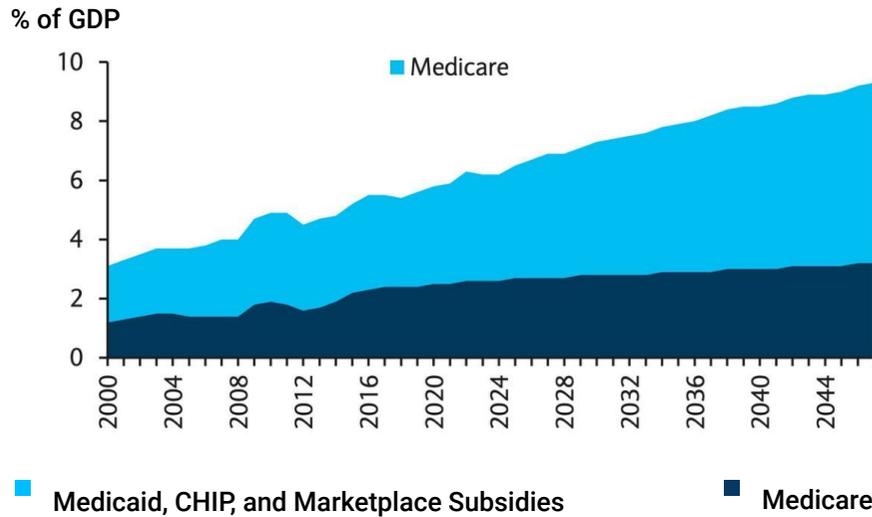
Not only do new methods of standard industry benchmarking and forecasting need to be developed to combat the issues of overcomplexity and multidimensionality in the longevity industry, but new methods of testing the basic safety and efficacy of longevity and precision health diagnostics, prognostics and therapeutics need to be adapted as well, moving away from the use of model organisms, towards a more human-centric approach.

## Precision Diagnostics



Gathering aging biomarkers means collecting data which marks the difference between healthy people only (e.g., between the young and even younger), with no traces of any officially recognized diseases. The continuous monitoring of small changes in such biomarkers, and the continuous and commensurate micro-adjustment of treatments in response, allow for some de facto reversal of biological age.

Federal spending on health care has increased substantially over the past several decades. Health spending growth has outpaced growth of the United States economy.



Life expectancy increases with increase in GDP per capita. The wide variation in the life expectancies for countries with high GDP per capita would be due to health care policy and health status of the population.

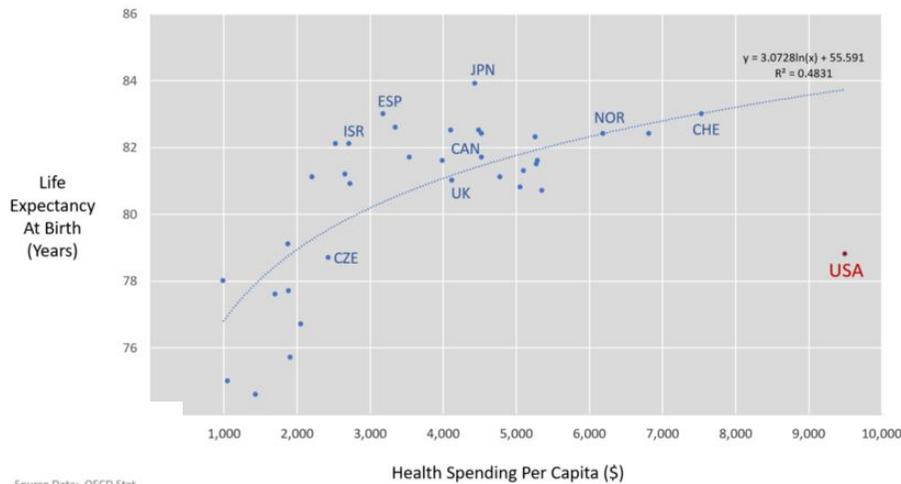


Sources:

World Economic Outlook

Geoba.se - Life Expectancy

Relation between life expectancy at birth and health spending per capita shows that life expectancy at birth increases at a decreasing rate with respect to health care spending per capita.



Source:

OECD Statistics

Health-Adjusted Life Expectancy (HALE), used here as a measure of healthy longevity, is the average number of years an individual can expect to live free of chronic age-related disease.



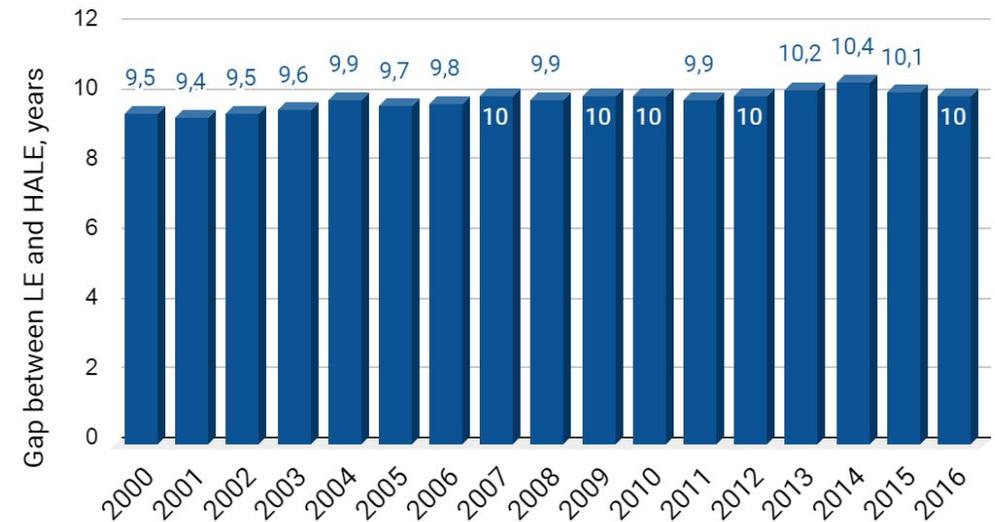
Source:

GHO Life expectancy and HALE

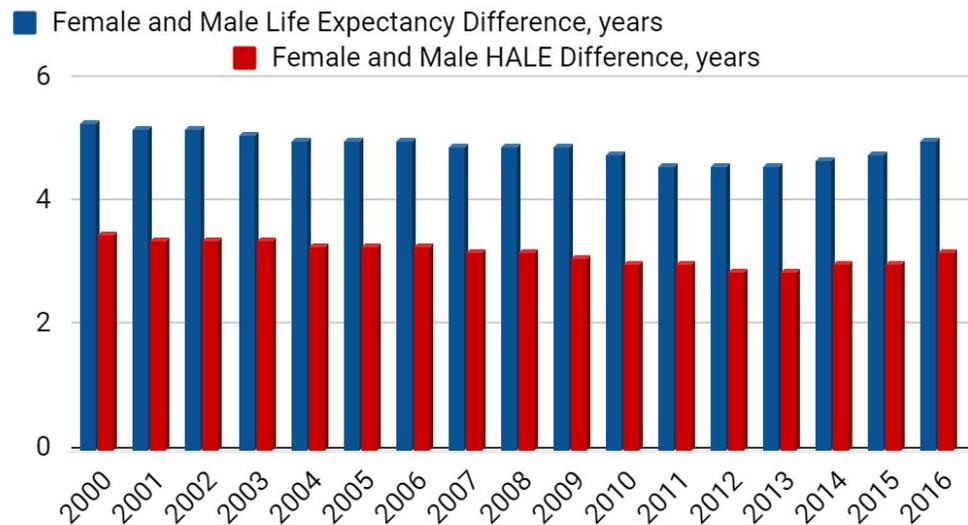
## Healthy Life Expectancy – Compared of US States

US States with Longest <i>Healthy</i> Life Expectancy	US States with Shortest <i>Healthy</i> Life Expectancy
1. Minnesota - 70.3 healthy years	50. West Virginia - 63.8 healthy years
2. Hawaii - 70.1 healthy years	49. Kentucky - 64.3 healthy years
3. California - 69.9 healthy years	48. Oklahoma - 64.5 healthy years
4. Washington - 69.1 healthy years	47. Alabama - 64.6 healthy years
5. Vermont - 69 healthy years	46. Mississippi - 64.9 healthy years

## Trends in Gap Between Life Expectancy and Health-Adjusted Life Expectancy



The difference in life expectancy at birth between white men and women declined from 5.3 years longer lives for women in 2000 to 4.7 years in 2013. Since 2014, the difference has begun to rise.



Source: [World Health Organization | Risk Factors](#) [Business Insider](#)

The average life expectancy in the US has been on the decline for three consecutive years since 2014.

Indicators	Absolute change (years)		
	2000-2005	2005-2010	2011-2016
Life Expectancy at birth	0.7	1.1	-0.3
Healthy life expectancy at birth	0.5	0.8	-0.4
Life Expectancy at age 60 years	0.7	0.9	0
Healthy life expectancy at age 60 years	1	0.6	0.1

# USA: Key Aging & Longevity Statistics

Life Expectancy	Both sexes life expectancy (2019)	79.4 years
	Male life expectancy (2018)	77.0 years
	Female life expectancy (2018)	81.9 years
GDP	GDP per capita, current prices (2018)	64.77 thousand (\$)
	GDP per capita, PPP (2018)	64.77 thousand (\$)
	GDP, current prices (2018)	20.494 trillion (\$)
Population Aging	Rate of population aging	3 (2007-2017)
	Aged over 65 (2018)	15.6%
	Age dependency ratio (2017)	23%
Health Care Efficiency	Health expenditure (2017)	17.2% of GDP
	Health expenditure per capita (2017)	10.209 thousand (\$)
	Health care efficiency score (2018)	29.6
Retirement	Total # retired	50,204,174
	Retired people proportion	15%
	Normal retirement age (Man/Woman)	66 years/66 years
	Early retirement age (Man/Woman)	62 years/62 years

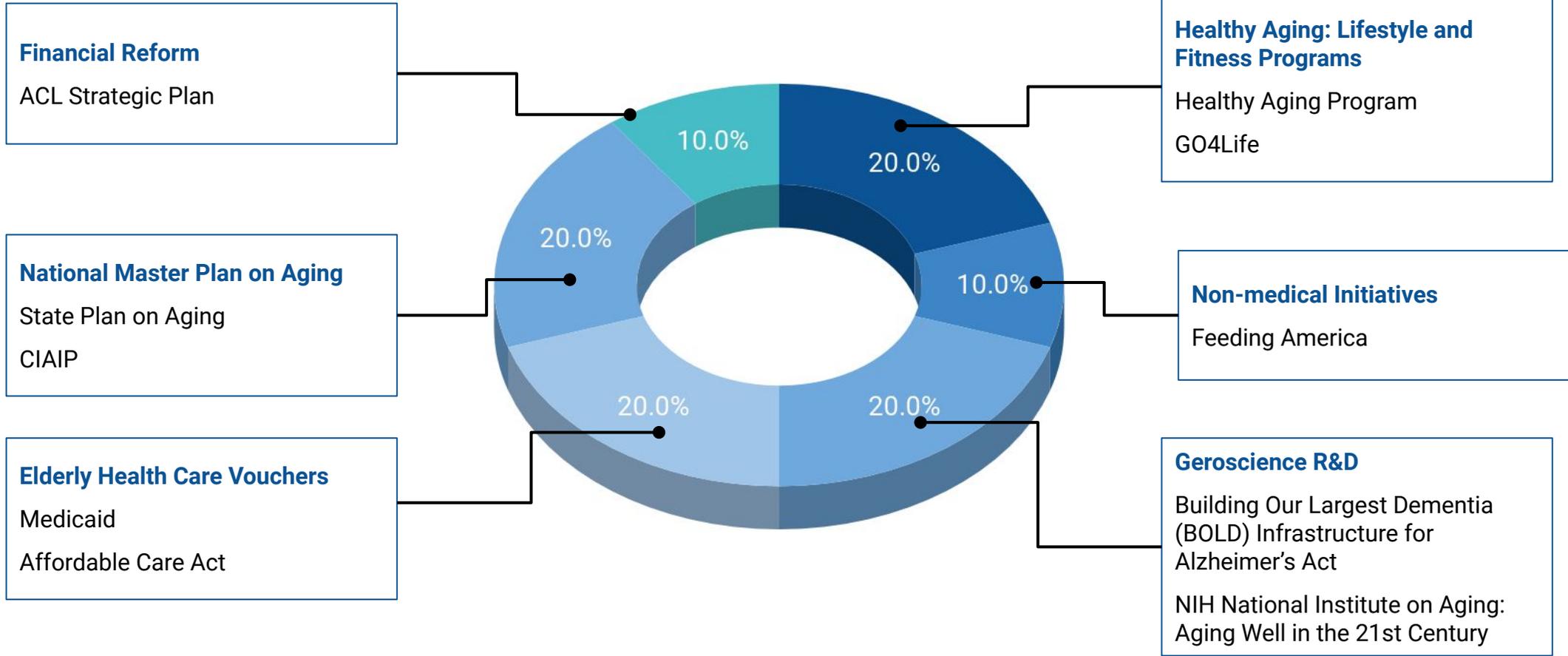
## Longevity Initiatives



- Age of relevant government-led longevity initiatives: **55 years**
- **288** of WHO age-friendly cities and communities
- **Master Plans** on state level:
- **6** initiatives focused on non-medical improvement of quality of life
- **1** initiative focused on preventive medicine and health care approaches
- **2** initiatives involve research or R&D of medicines that directly impact aging

# USA Government-led Longevity Initiatives

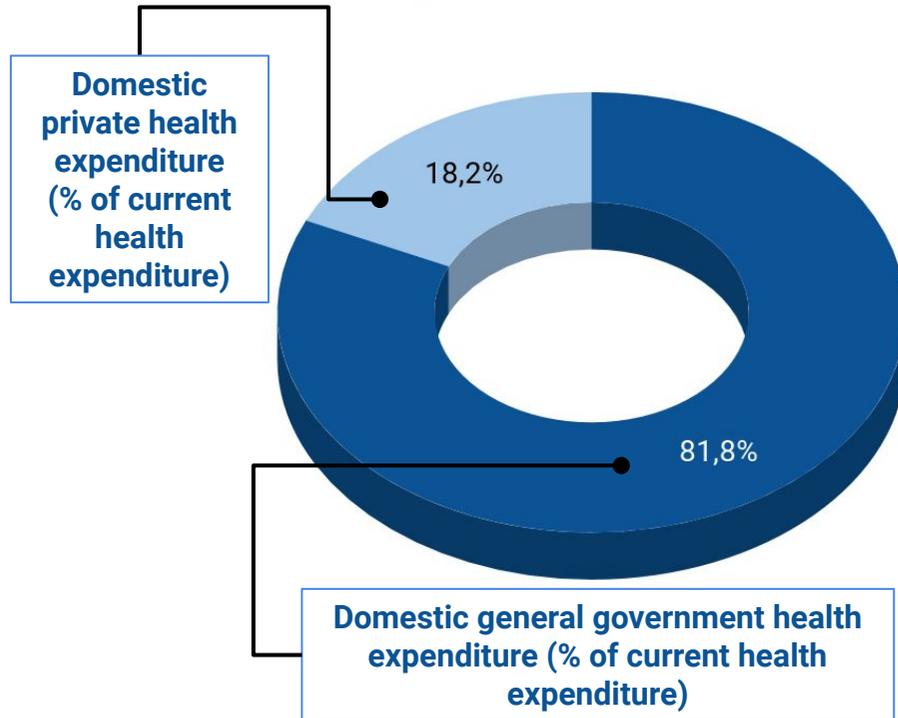
## Level of Comprehensiveness



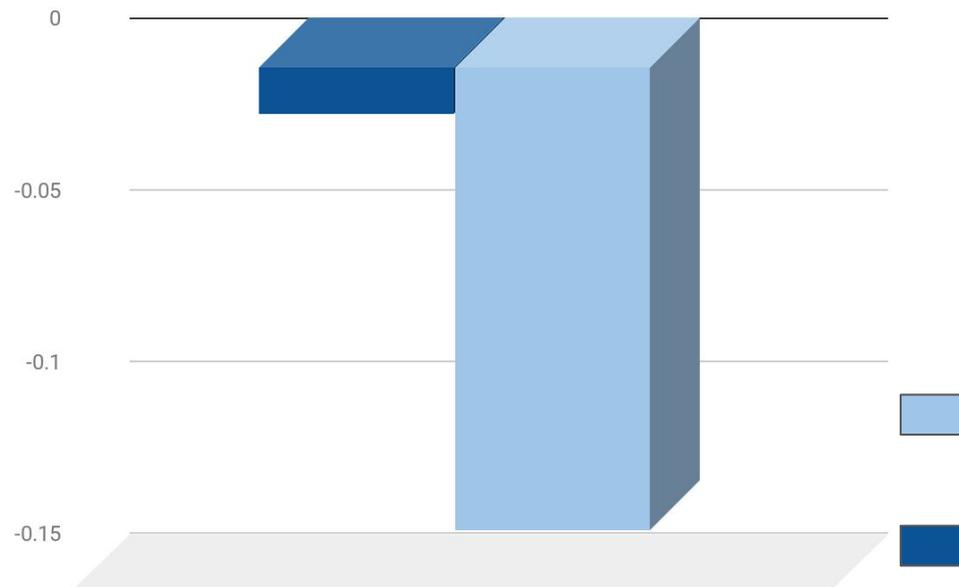
### Underrepresented Initiatives

Preventive Medicine	AgeTech	Longevity Industrial Strategy	Continuing Education
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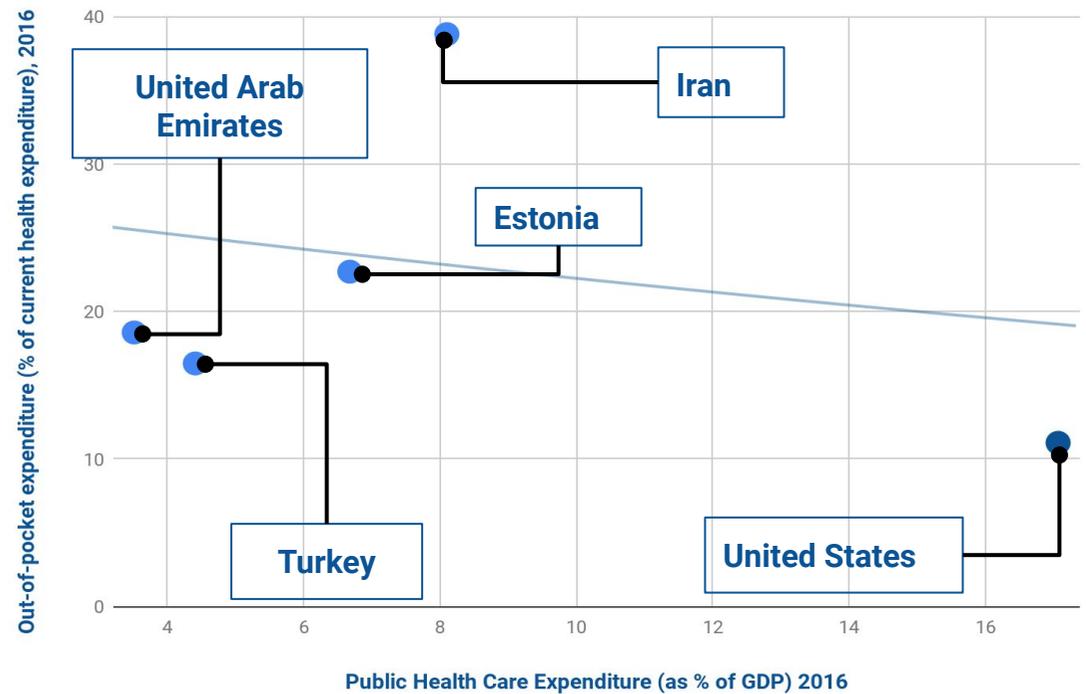
## Current Healthcare Expenditure



## Effectiveness ratios



## Countries with Low HALE and Life Expectancy and High Gap



In order to improve their National Healthy Longevity and Health-Adjusted Life Expectancy (HALE) the government of United States should prioritize the development of a competitive Longevity Industry Development Plan, prioritize Healthy Longevity as a major national priority item, improve health insurance for poor population to reduce income-based healthcare inequalities, and allocate more healthcare dollars to preventive medicine, early diagnosis of disease, healthy lifestyle programs, and Artificial Intelligence for preventive medicine in particular.

HALE and Life Expectancy Difference CAGR (6 years)/Current health expenditures per capita (current US\$), CAGR (6 years)

HALE CAGR (6 years)/Current health expenditures per capita (current US\$), CAGR (6 years)

# Conclusions

## **I. The prevalence of NCDs are considered to be a “slow motion disaster.”**

Noncommunicable diseases (NCDs), also known as chronic diseases, tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behavioral factors. Such diseases have common metabolic roots, and their interconnection can be called “**metabesity.**”

## **II. All risk factors of NCDs lie in non-health sectors, requiring collaboration across all of government and all of society to combat them.**

Noncommunicable diseases are driven by forces that include unplanned urbanization, globalization of unhealthy lifestyles and population aging. Unhealthy diets and a lack of physical activity may show up in people as raised blood pressure, increased blood glucose, overweight and obesity. These are called metabolic risk factors that can lead to cardiovascular disease, the leading NCD in terms of premature deaths.

## **III. The United States life expectancy at birth ranks 25th in the world, and yet its health care expenditures are the highest among all developed countries.**

US health expenditures are projected to grow at an average annual rate of 5.5% during 2018–27 and represent 19.4% of gross domestic product in 2027. Although expected life span will rise globally in 2040, the United States, despite the projected increase in its health care spending, is expected to further plunge in life expectancy rankings in 2040 – from 43rd place to 64th – the largest decrease for a country defined as high income.

## **IV. Preventive care is the best way to lower the United States health care costs.**

The United States needs a new approach that shifts away from “sick care” to a model of empowering overall health and wellness, providing patients with access to proactive care that identifies risk and manages chronic disease early to prevent escalation and deterioration.

# Conclusions

## **V. This shift from treatment to prevention is ultimately leading to a coming age of precision health.**

“Precision health” denotes the continuous stabilization of health and the maximum-obtainable maintenance of a young biological age via the routine application of micro-interventions in response to ongoing fluctuations in biomarkers of aging and health.

## **VI. Utilizing strength of the USA in artificial intelligence industry leads to meaningful improvements in medical care.**

Translating the tremendous growth in data into clinical insights falls into the hands of AI (artificial intelligence)/ML (machine learning) platforms. The rapid growth in investment in AI and cloud computing are beginning to create the foundations for the precision health market of the future. But apart from advanced research it is important to provide effective, low-cost treatments that work, triggering unnecessary treatments and higher costs down the line.

## **VII. Tackling wasteful spending on health in clinical care, operational costs and administrative expenditures.**

Acting in the detection, prevention and response to fraud in the delivery and financing of care, development of robust information systems to identify low-value care, combat inappropriate business practices, launching of patient-reported measures to receive value and safety from the perspective of care recipient can lead to decrease in inefficiency of health care system. In general, strategies to reduce waste can be summed up as: stop doing things that do not bring value and swap when equivalent but less pricey alternatives exist

## **VIII. A focus on national-level health status and its temporal trajectory is critical.**

Health status is one of the most important indicators of well-being, and it predicts a large proportion of societal expenditures on health and social services for the elderly. It depends on individual lifestyle factors, social and community networks, general socioeconomic. Health status is also reciprocally affected by social and political policies and programs.



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Link to the Report: <https://aginganalytics.com/longevity-and-metabesity-usa>

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**AGING ANALYTICS AGENCY** is the world's premier provider of industry analytics on the topics of longevity, precision preventive medicine and economics of aging, and the convergence of technologies such as AI and digital health and their impact on health care. The company provides strategic consulting services in fields related to longevity, and currently serves as the primary source of analytics for the specialized hybrid hedge fund Longevity.Capital, as well as the UK All-Party Parliamentary Group for Longevity.

**TARGETING METABESITY 2019** focuses on shifting the emphasis from treatment to prevention, and going beyond managing individual diseases to extending healthy lifespan. Gathering will be stellar speakers and participants from science and medicine, government regulation and policy, health care organizations, industry (drugs, devices, nutritional, and digital products), capital markets, patient advocacy, and other fields, held this year at the Carnegie Institution for Science in Washington, DC, 15-16 October 2019.