AGING
ANALYTICS
AGENCY

INVESTMENT DIGEST

LONGEVITY INDUSTRY 2021

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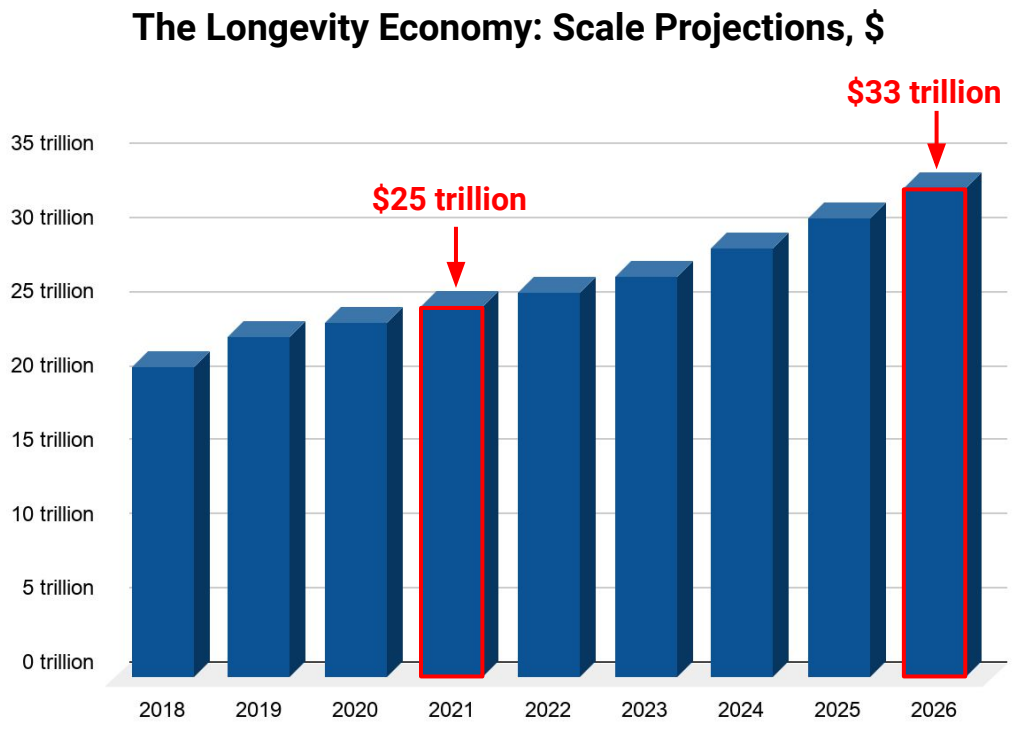
Longevity Investment Digest at a Glance

This Investment Digest summarizes key observations in the private equity and venture capital ecosystem of the rapidly evolving and exponentially growing Longevity Industry. In it, we have assembled information about key industry trends, more than 20,000 longevity companies, 50 leading investors, and more than 300 longevity-focused publicly traded corporations. We have also outlined major investment rounds and relevant R&D trends, illustrating the industry's traction and readiness of institutional investors (including top-tier financial institutions) to potentially acquire the most successful startups, such as AgeTech, Longevity Fintech, and Longevity Biomedicine.

The COVID-19 pandemic has given a boost not only to the growth of the biotech capital market, but also to the development of the longevity biomedicine sector, resulting in an increase of more than 30% (compared to the previous year). Though the growth in the longevity market exceeds that of in the biotech and financial services markets, it still remains pretty volatile. 19 longevity-focused companies launched their IPOs in 2020, whereas more than a thousand of them received private equity investments. Currently, the growth rate of the longevity market is comparable to that of the IT sector. Longevity is regularly picked as a major topic of interest for panel discussions and entire conference series by top-tier finance and business media brands, including The Economist, Financial Times, and Bloomberg.

To sum up, the Longevity industry is poised to witness a quantum leap in the near future, particularly because of the impact of Artificial Intelligence on biomedicine R&D and in light of the upcoming paradigm shift from treatment to prevention.

The Longevity Economy on a Global Scale

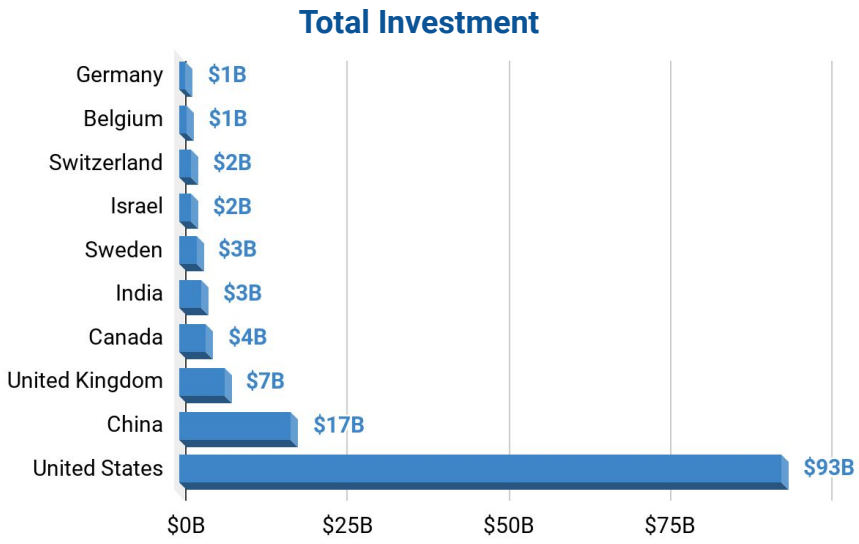


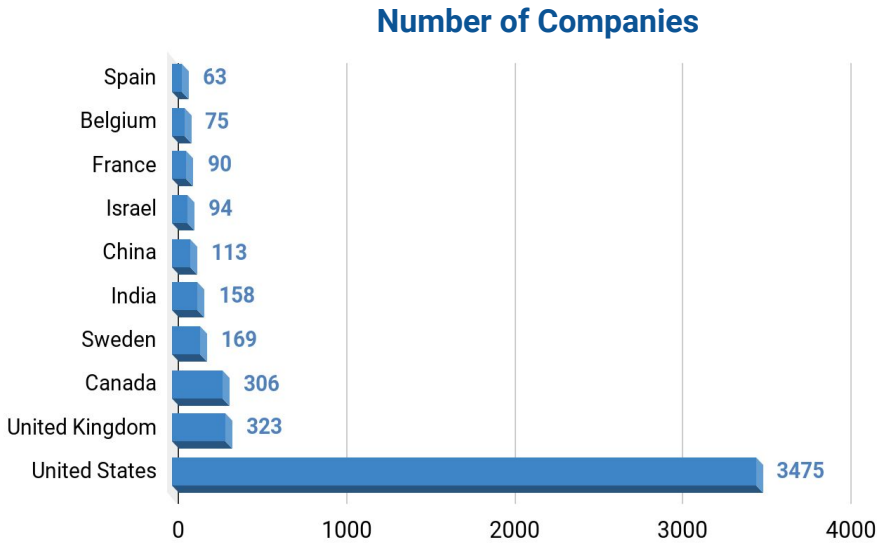
Longevity Biomedicine is currently the main focus of venture investors looking to invest in the longevity industry; however, it is only a tiny fraction of the longevity market.

Not only does aging pose one of the most acute problems of our time - it also presents one of the most promising opportunities. Financial institutions, such as investment banks, pension funds, and insurance companies, can either sink or swim when hit by the oncoming Silver Tsunami. Whether they will succeed in riding the wave or end up drowning under it will depend not only on their willingness to deploy new business models adapted to population aging and emerging industries of AgeTech, WealthTech, and Longevity Finance, but also on the quality of longevity analytics that they use to develop such business models.

We define the Longevity Industry as a combination of aging, advanced preventive precision biomedicine, AgeTech, relevant parts of national healthcare budgets, and the global financial industry related to such sub-industries.

Top 10 Countries in the Longevity Sector in 2021





The chart on the left represents the top 10 countries with the largest investment in the Longevity Industry (as of May, 2021). The chart on the right shows the top 10 countries for the number of longevity-focused companies (as of 2020). The undisputed leader here is the US which has a total of $93.3 billion invested in 3,475 companies. It is followed by China, the second largest country for longevity investment, which has a total of $17.4 billion invested in 113 companies. China's closest competitor is the United Kingdom where funds are mostly raised from public sources and IPOs, and not from private investors.

Top-20 Longevity Companies

Jiangsu

BeiGene
Changping, Beijing, China

BlueRock Therapeutics
Toronto, Ontario, Canada

Maharashtra

PharmEasy
Mumbai, Maharashtra, India

California

Abcam
Cambridge, Cambridgeshire, UK

Juvenescence
Douglas, NA - Isle of Man, Isle of Man

Samumed
San Diego, California, US

One Medical
San Francisco, California, US

Freenome
South San Francisco, California, US

Human Longevity
San Diego, California, US

UNITY Biotechnology
Brisbane, California, US

Geron
Menlo Park, California, US

Epirium Bio
San Diego, California, US

Massachusetts

Amwell
Boston, Massachusetts, US

Decibel Therapeutics
Cambridge, Massachusetts, US

Navitor Pharmaceuticals
Cambridge, Massachusetts, US

Washington

Sana Biotechnology
Seattle, Washington, US

Colorado

SomaLogic
Boulder, Colorado, US

Maryland

Osiris Therapeutics
Columbia, Maryland, US

New Jersey

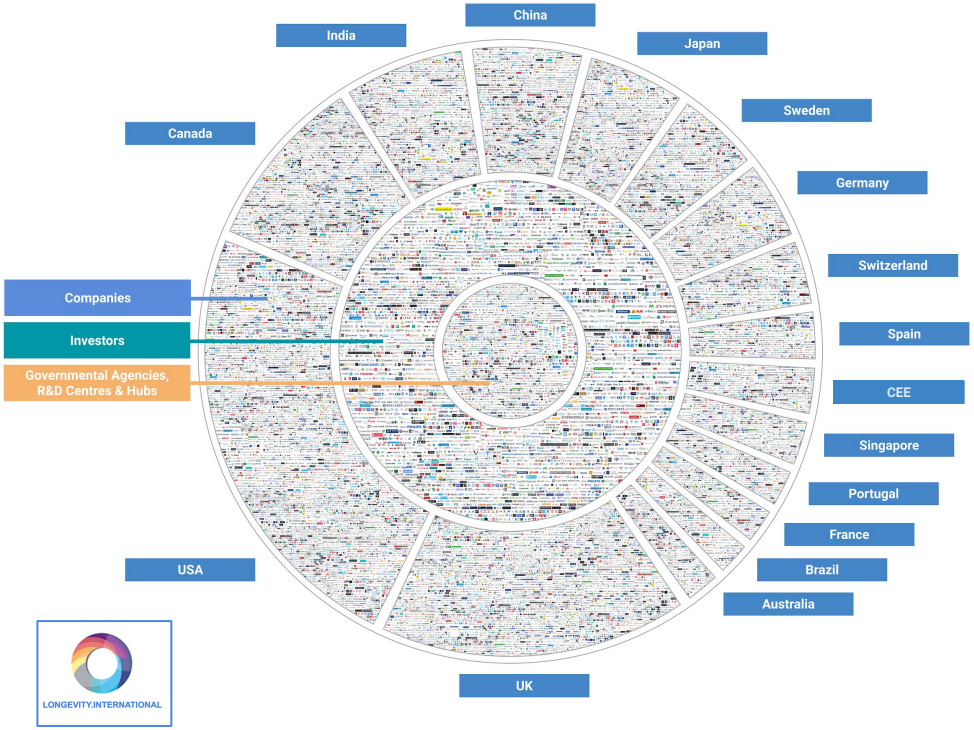
Celularity
Warren, New Jersey, US

Tel Aviv

EarlySense
Ramat Gan, Tel Aviv, Israel

Global Longevity Ecosystem 2021

20 000 Companies	8000 Investors	400 Hubs



USA	UK
Canada	India
Japan	China
Sweden	Germany
Switzerland	Spain
CEE*	Singapore
Portugal	France
Brazil	Australia
Gulf Region	EU

* – Central and Eastern Europe

Global Longevity Ecosystem - 20 000 Companies by 16 Sectors

LONGEVITY.INTERNATIONAL

Geroscience

Longevity WealthTech

Space Medicine

Deep Diagnostics

Longevity Biomarkers

FinTech

Longevity FemTech

Regenerative Medicine

AI for Longevity

InsurTech

Advanced Cosmetics

Longevity Gene Therapy

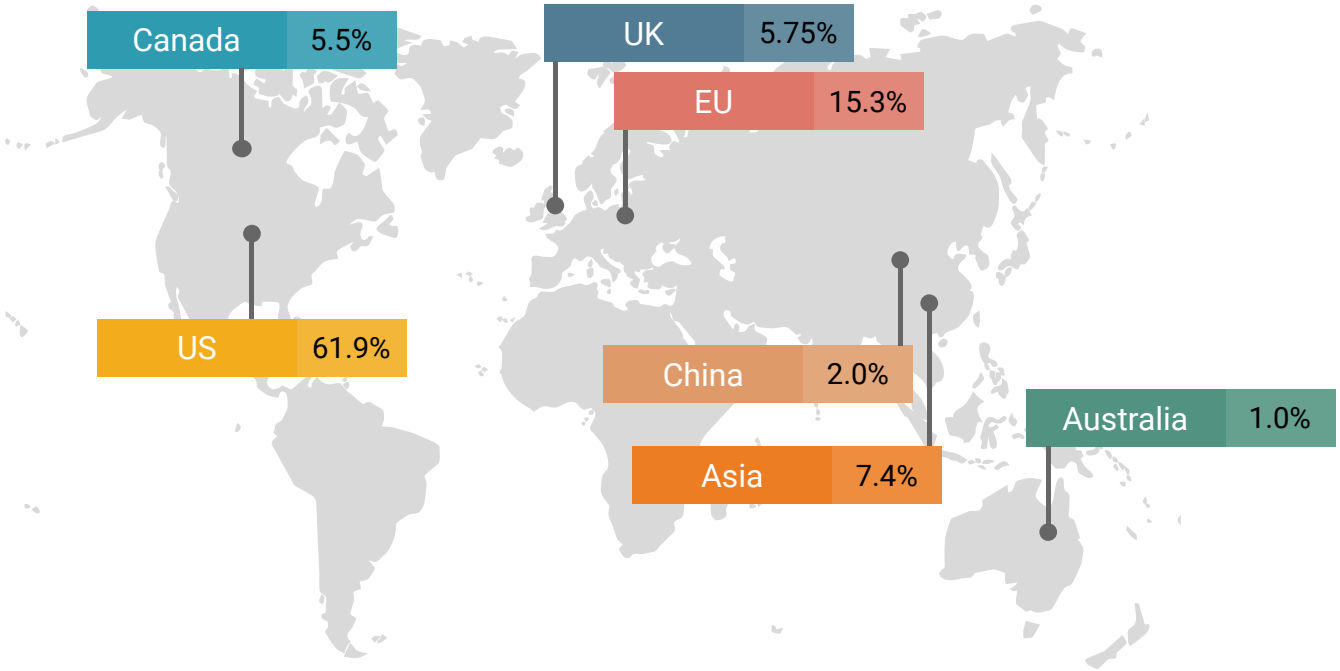
NeuroTech

AgeTech

Clinical Data Management

P4 Medicine

20 000 Companies: Regional Proportion



The US is still firmly in the lead in terms of the number of longevity-focused companies, and the EU is the second biggest market in the world. However, Asia increased the market share to 9.4% (represented by 5,627 companies of different sizes and funding structures) and keeps growing today. We expect steady growth of the Asia companies with increasing the number of public offerings among them.

Longevity Industry: Multi-Trillion Dollar Opportunity

Longevity, AgeTech & WealthTech Market

Globally
1 Billion in Retirement

In the UK
10 Million in Retirement

FT FINANCIAL TIMES

"The one billion retired people globally are a multi-trillion dollar opportunity for business "

~ Dmitry Kaminskiy, inverview in the Financial Times

"We expect to add 1 billion older individuals in the next three to four decades, atop the more than 700 million older people we have today "

~ International Monetary Fund

INTERNATIONAL MONETARY FUND

The “7th Continent” of 1 Billion People in Retirement

There are more than 1 billion people aged 60 years and older in the world nowadays. In fact, there are so many of them that they can populate an entire ‘7th Continent’.
Not only do they wield immense purchasing power, but they also hold the largest amount of financial assets compared to other age groups.

www.aginganalytics.com/asia-investment-digest

Longevity Industry: Multi-Trillion Dollar Opportunity

The Global Longevity Market is Estimated at $25 trillion in 2021

20 000+ companies	350+ corporations
8000+ investors	1000+ financial institutions
100+ governments	114 subsectors

The longevity market is not only limited to anti-aging applications of life sciences. It also includes some new sectors of the financial industry, as well as government projects (national longevity development plans); hence, its overall size can potentially exceed $25 trillion. As the majority of full-blown longevity startups are quickly becoming mature companies, large institutional investors are making increasingly more investments into the industry and a full-fledged longevity infrastructure is emerging.

There are at least 350 publicly traded corporations that can be considered part of the Longevity industry.

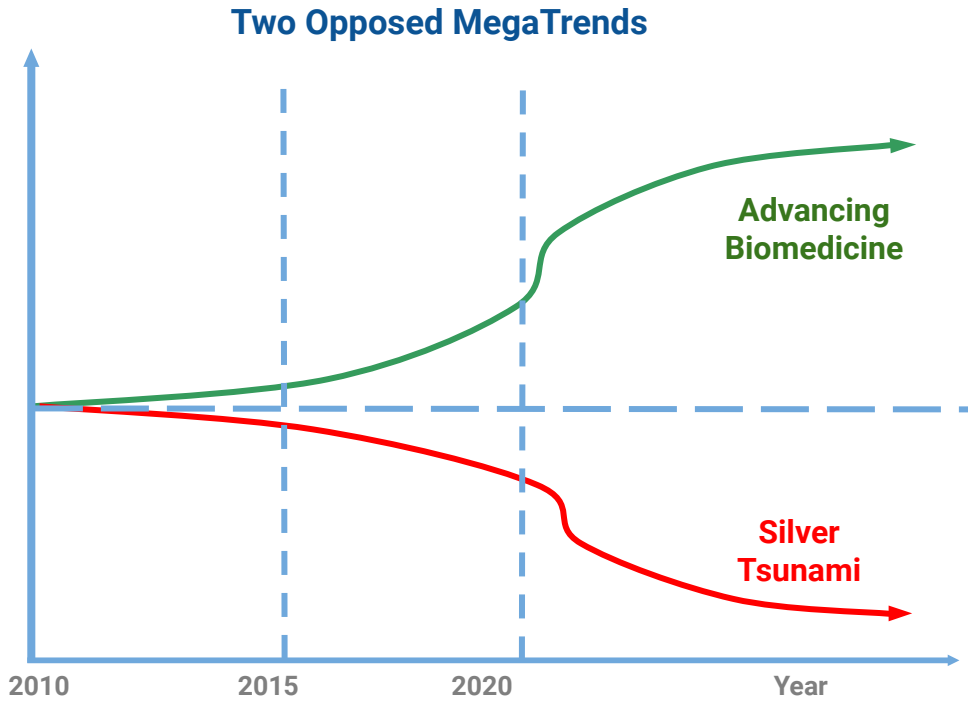
Longevity Biomedicine, FinTech, and AgeTech industries include 20,000+ companies, 8,000+ investors, 14 sectors, and 114 subsectors.

The longevity Financial Industry includes 1000+ corporations, 15 sectors, and 50 subsectors.

The Longevity Governance Landscape includes national healthcare budgets and development plans of at least 100 governments.

Note: Since there is no generally accepted methodology for their estimation, the numbers presented in the scheme are approximate.

Longevity and Silver Tsunami - Collision of Two Opposing MegaTrends



Rapid progress in biomedicine has been mainly due to the advances in collection and analysis of data. The industry is poised to witness a quantum leap in the near future, particularly because of the impact made by Artificial Intelligence on biomedicine R&D and in light of the upcoming paradigm shift from treatment to prevention.

At the same time, the inevitable Silver Tsunami (demographic aging) places a major economic burden not not only on the healthcare systems of developing nations, but also on major financial institutions, including pension funds, insurance companies, asset management firms and retail/private wealth banks. It is also expected to increase costs associated with old age.

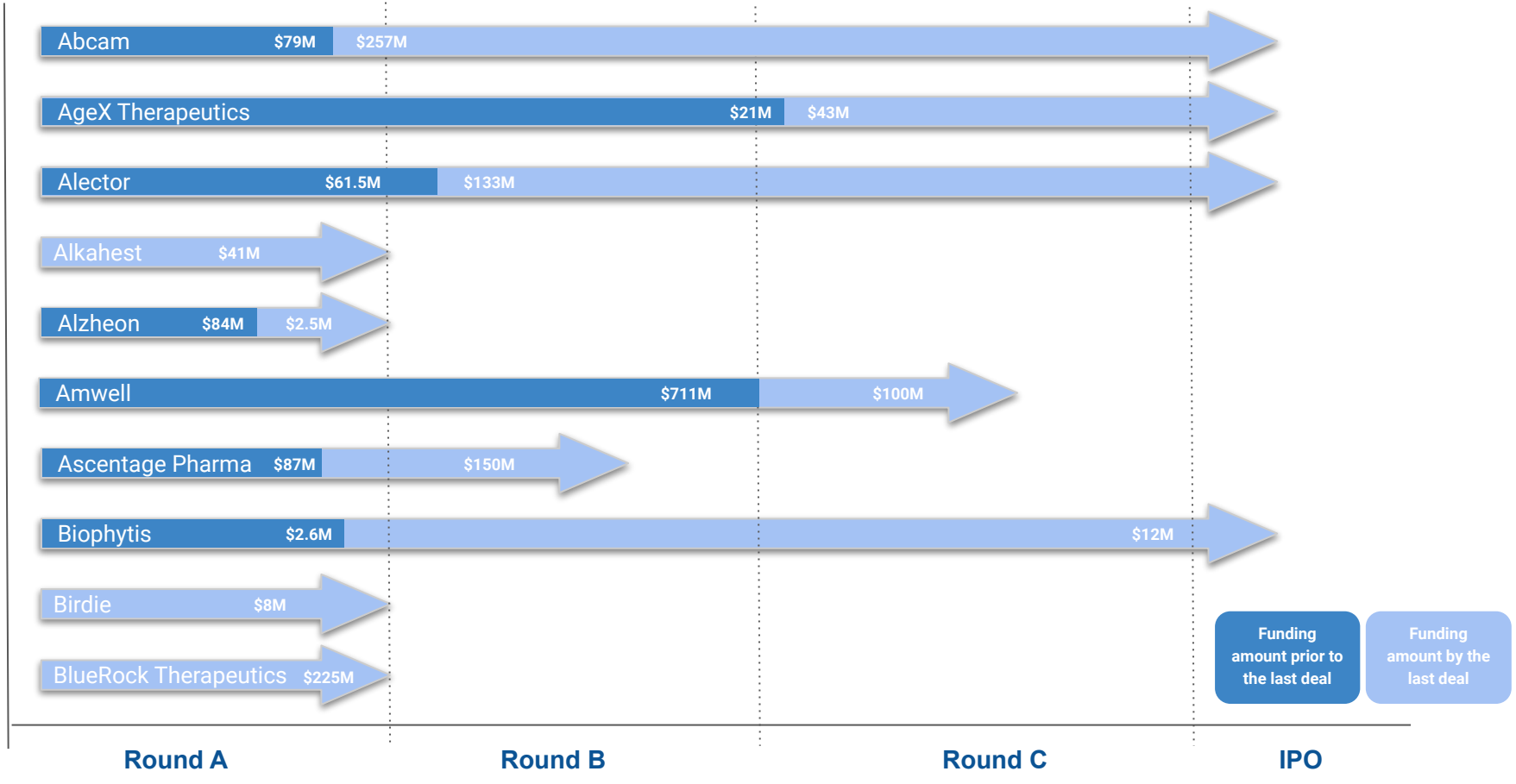
Top-5 Longevity Investment Deals in 2020-2021

In 2020, total investments in longevity-focused companies exceeded $156 billion, of which $60 billion were raised during the last year.

Some of the major deals included:

- **Sana Biotechnology** — $700 million in initial financing to advance the company's discovery and development programs that create and deliver engineered cells as a treatment for different disease types (Series A round);
- **Cue** — $481M (grant from US government);
- **Freenome** — $270M to advance novel multiomics blood resting platform for early cancer detection (Series C Round);
- **Recursion Pharmaceuticals** — $239M (Series D Round led by Bayer);
- **ElevateBio** — $170M which will be directed toward manufacturing cell and gene therapies, enabling new technology platforms, and pursuing therapeutics (Series B Round).

Top Companies by Investment and Investment Stage



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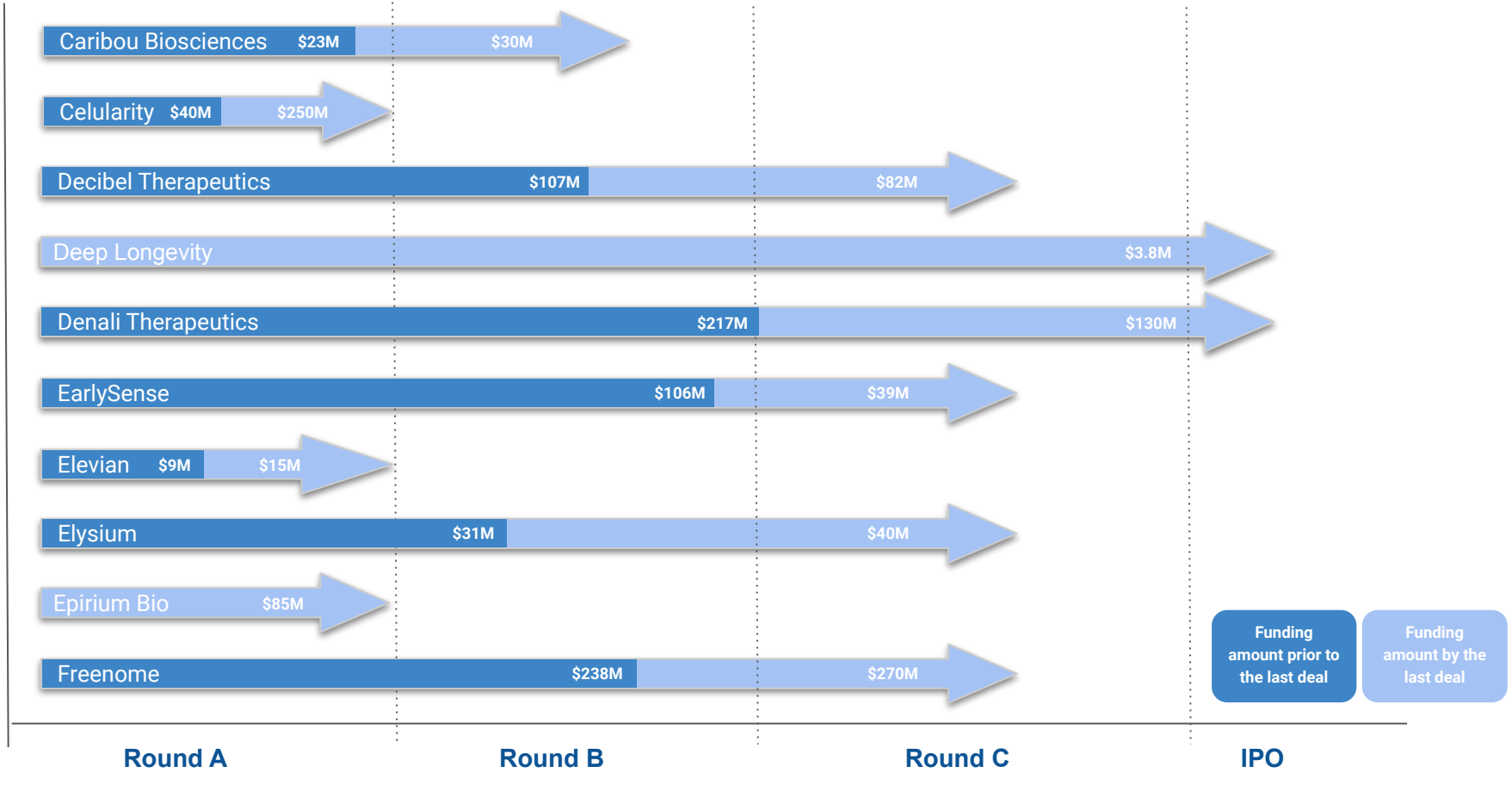

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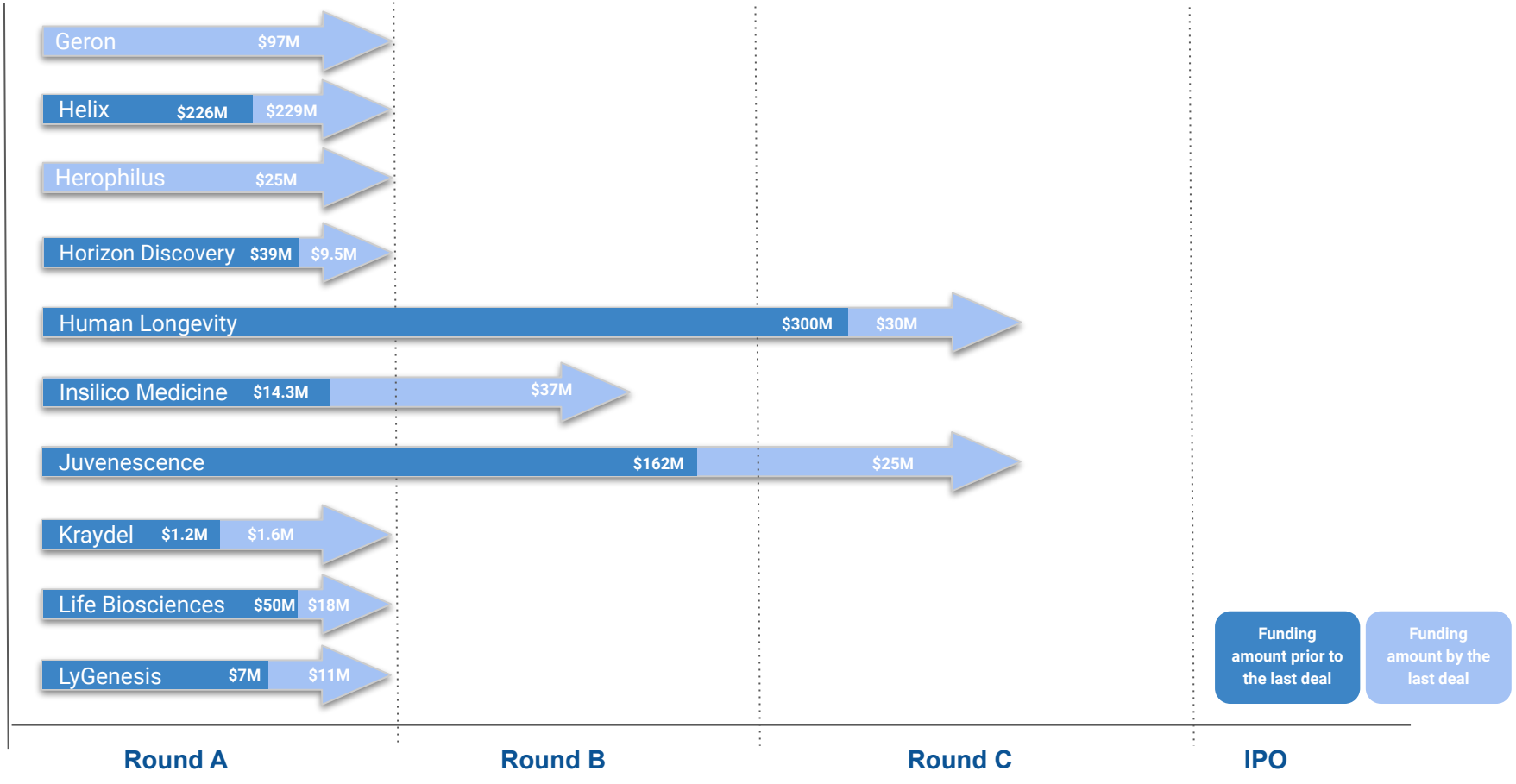

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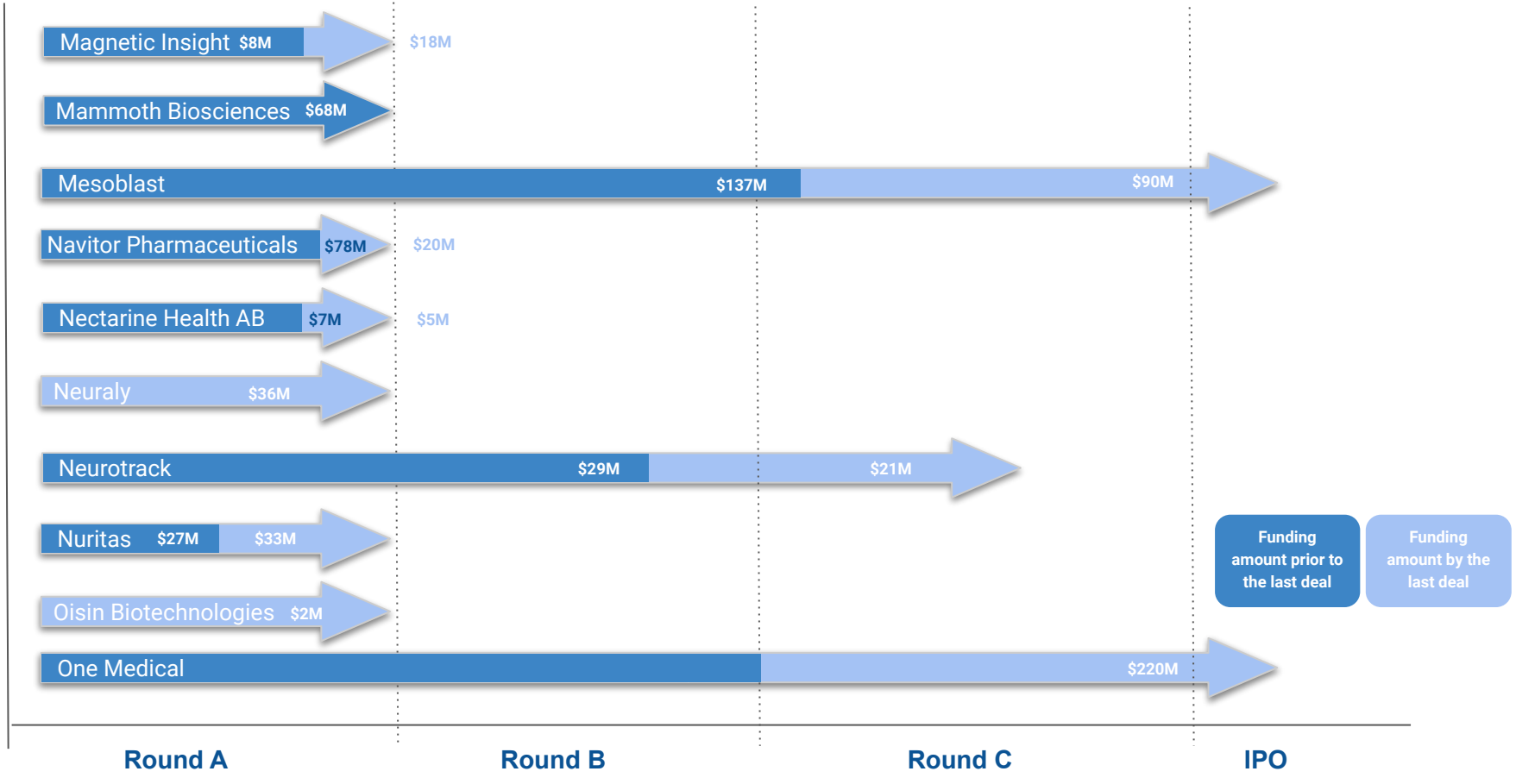
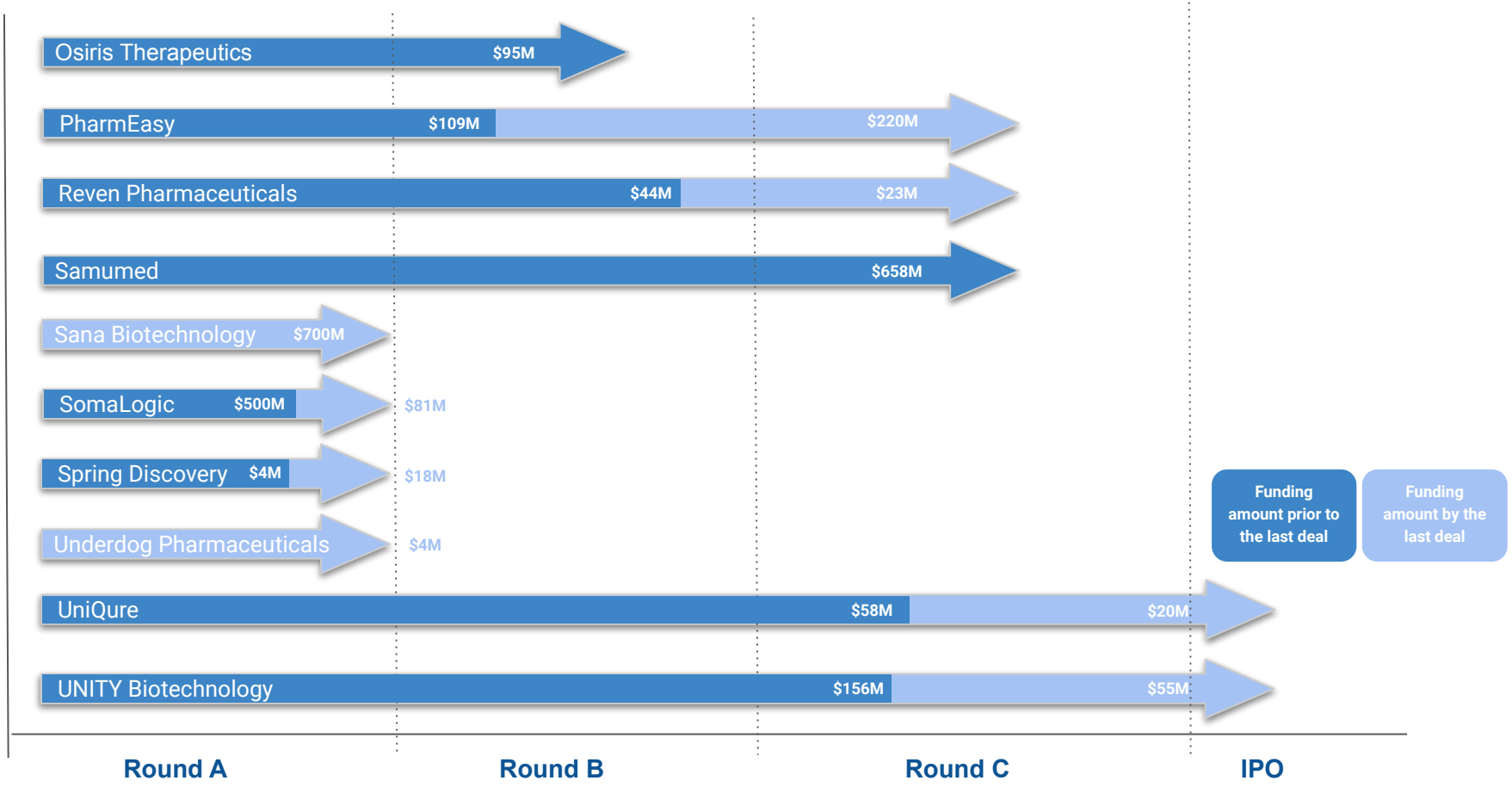


Top Companies by Investment and Investment Stage



Investment Landscape at a Glance (2020 — 2021)

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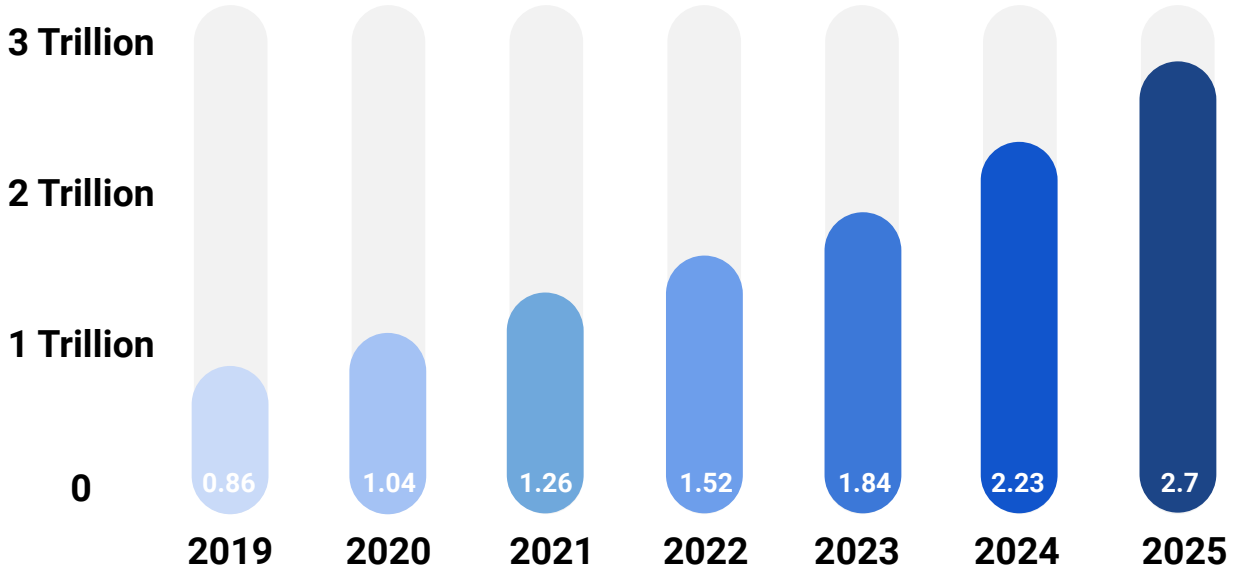
Top-5 Investment deals

AgeTech Industry Market Capitalisation



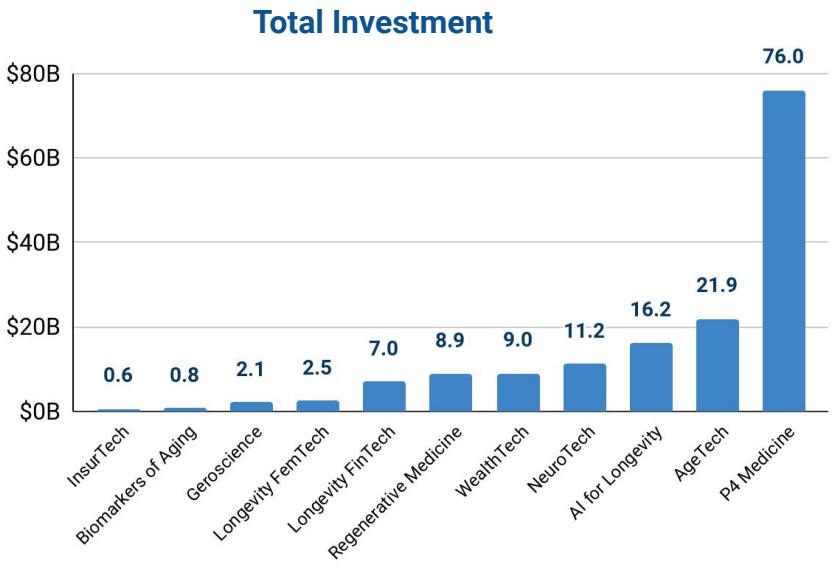
World AgeTech Industry Size Projections, current US $

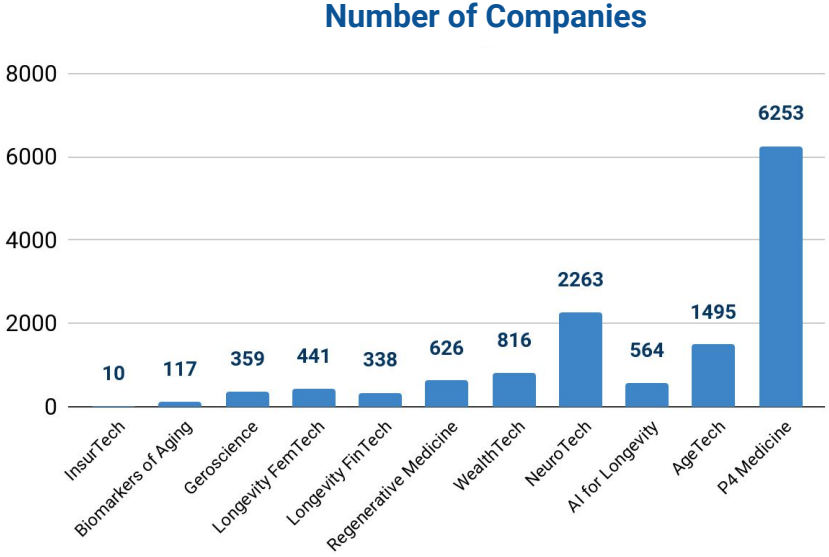
AgeTech Sector:

- Elderly Care
- FinTech
- m-Health
- Senior Living Communities
- Social and Communication Caregiving
- Independence
- Social Protection
- Cognitive Care

Estimated at $17 trillion in 2019, the global longevity economy is growing steadily and expected to be worth $27 trillion by 2026. By the most conservative estimates, it accounts for 20% of the global GDP. While the global Longevity Economy is projected to reach $27 trillion by 2026, the Age-Tech segment alone is projected to reach $2.7 trillion by 2025. This, in turn, implies an annual growth rate of 21% in the global Age-Tech market, which is attributable to the development of the elderly care sector enhanced by IT, FinTech, and other digital technologies.

Investments in the Longevity Industry





Early-Stage Investments in Longevity in 2020: $156 Billion

P4 Medicine (Precision, Preventive, Personalized, Participatory) is the largest sector in the Longevity Industry in terms of funds raised and companies involved. Two of its sub sectors - Diagnostics and Mobile Health - are the undisputed leaders in attracting investment.

The distribution of investments across different sectors of the Longevity industry demonstrates that investors tend to invest more into drug and gene therapies than into devices (**Agetech**). However, as society's focus is shifting towards keeping older people healthy and active for longer, tech-enabled care and mobility aids, the two key areas of age-tech, are very likely to attract even more investment in the near future.

Longevity Industry Subsectors

AGING ANALYTICS AGENCY

AGETECH

Digital, IT and mechanical technologies aiming at prolonging physical functionality and wellbeing in elderly demographics

AI FOR LONGEVITY

Application of Artificial Intelligence for longevity research and development, including AI for drug discovery and biomarker development

FEMTECH

FemTech products and services targeting core female-specific hallmarks of aging and/or aspects of aging. Prominent sectors include fertility, ovarian rejuvenation

GEROSCIENCE

Biomedical therapies targeting the root causes (or "hallmarks") of aging, including Cellular Senescence, Stem Cell Exhaustion, Epigenetic Alterations, Altered InterCellular Communication, Loss of Proteostasis, Deregulated Nutrient Sensing, Mitochondrial Dysfunction, Telomere Attrition and Genomic Instability

P4 MEDICINE

P4 (Precision Preventive Personalized Participatory) diagnostic, prognostic and therapeutic technologies to maintain an optimal state of health for as long as possible. Considered as the leading edge of practical applications of Longevity technologies

REGENERATIVE MEDICINE

Cell therapies, bioengineered organs, tissue engineering and xenotransplantation targeting core hallmarks of aging

BIOMARKERS FOR LONGEVITY

Discovery and development of panels of biomarkers of aging, the core infrastructure required for testing the safety and efficacy of Longevity therapies and the effectiveness of interventions

LONGEVITY NEUROTECH

NeuroTechnologies to improve and maintain cognitive abilities, neurological plasticity, sleep quality (SleepTech) and psychological well-being into later stages of life

Longevity Landscape Framework

AGING ANALYTICS AGENCY

Geroscience R&D

- Rejuvenation Biotechnology
- Basic Research on Biology of Ageing
- Geroprotectors
- Regenerative Medicine
- Nutraceuticals
- Gene Therapy

P4 Medicine

- Personalized Diagnostics
- Personalized HALE and QALE Estimation
- Personalized Prognostics
- Personalized in vivo and in silico Drug Testing
- Preventive Therapies
- Participatory Medicine

AgeTech

- NeuroTech
- Cognitive Enhancement
- Smart Homes
- NextGen Mobile Apps for the Elderly
- Continuing Education
- Entertainment for the Elderly

Longevity WealthTech

- Financial Planning
- Asset Management
- Micro-Investments
- Digital Brokers
- AI-Driven Assistants
- Long-Term Securities

Longevity Finance

- Longevity Index Fund
- Longevity Hedge Fund
- Longevity Stock Exchange
- AgeTech Bank
- Longevity Derivatives
- Longevity Investment Bank

Longevity Governance

- Pension Plans
- National Healthcare Budgets
- Longevity Development Strategies
- Elderly Care Programs
- National Insurance
- Elderly Education

Longevity Financial Industry Framework

AGING ANALYTICS AGENCY

InsurTech

- HALE/QALE-Based Insurance
- AI-Driven Insurance Premium Calculation
- NextGen Mobile Apps
- Healthy Lifestyle Bonuses
- Big Data Actuarial Models
- Biological Age Estimation

WealthTech

- Robo-Retirement
- Digital Brokers
- Micro-Investments
- Annuities
- Long-Term Securities
- AI-Driven Advisors

Longevity Asset Management

- Novel Retirement Plans
- Portfolio Management
- FinTech for the Elderly
- NextGen Mobile Apps for the Elderly
- Financial Planning
- De-Risking

Novel Financial System

- Longevity Index Fund
- Longevity Hedge Fund
- Strategies Diversification
- AgeTech Bank
- Longevity Derivatives
- Pension Planning

Most Advanced Pension-Tech Companies

Aging Analytics Agency has analyzed the most advanced pension-tech companies and concluded that the majority of them are based in the UK and EU.

Top Longevity Companies

Regenerative Medicine

Universal Cells
Osiris Therapeutics, Inc.
Vericel
Longeveron Biological Solutions for Aging
Silene Biotech
Athersys Inc.
AxoGen
samumed
ViaCyte Regenerating Health
Elevian
mesoblast the regenerative medicine company
Cyfuse
Pluristem Therapeutics Inc
cytori
AgeX Therapeutics
鑫品生醫 (4170) VectoriteBiomedical
celularity
Videregen
Regenesis Biomedical
Fibrocell Science
PureTech Health

P4 Medicine

BGI 华大
editas Medicine
Kailos Genetics
Helix
color
Genetron 泛生子 Answers for Cancer
Origen
BioLife Solutions Powering the Preservation Sciences
Veritas The Genome Company
Population Bio A Precision Medicine Company
Phigenix, Inc. Pharmaceutical and Biomedical Research Company
Biomarker Pharmaceuticals, Inc.
bluebirdbio
微芯生物 ChipScreen
Eve Biomedical
Fronteo
Precision Medicine Group
Centrillion Technologies
Turning Point Therapeutics
Everist Health

Biomarkers for Longevity

abcam
Astute Medical
Althea Dx
Critical Diagnostics
feel
freenome
Congenica
nanoString
Metabolon
Stemina Biomarker Discovery
nucleix
Biocartis
mission bio
Insilico Medicine
abcodia
1Drop Diagnostics

Geroscience

Alkahest
Juventas Therapeutics
Juvenescence
Everon Biosciences
Unity Biotechnology
mitobridge
NuSirt
Insilico Medicine
Chronos Therapeutics
BioAge Labs
CohBar Inc.
BioTime
AgeX Therapeutics
Human Longevity, Inc.
geron
Longevity Biotech
Mitotech SKQ
MacuCLEAR

Top Longevity Venture Firms: Landscape

Regenerative Medicine

SPARK @nn arbor usa
HYDRA CAPITAL
ALEXANDRIA
EASTON CAPITAL
BEZOS EXPEDITIONS
JUVENESCENCE
ACCUITIVE MEDICAL VENTURES
Deerfield Partners
EcoR1 CAPITAL
CP CardinalPartners
SYNO CAPITAL 兴诺资本
OXFORD FINANCE
NEW SCIENCE VENTURES
Groupe Nivelinvest
DEERFIELD
MERCK VENTURES
ARCH Venture Partners
BRCC BIOSCIENCES RESEARCH AND COMMERCIALIZATION CENTER
svb Silicon Valley Bank
HORIZON VENTURES
GE Capital
VIVES Louvain Technology Fund
CAPITAL SPRINGBOARD
CIRM CALIFORNIA'S STEM CELL AGENCY
STARTUP + HEALTH

Geroscience

General Catalyst Partners
ODEY ASSET MANAGEMENT
OrbiMed Healthcare Fund Management
PiperJaffray REALIZE THE POWER OF PARTNERSHIP
AspireCapital Invested In Your Success
Shibuya
POLARIS PARTNERS
GE VENTURES
APOLLO VENTURES
G/
mann BIOINVEST
illumina
DEEP KNOWLEDGE LIFE SCIENCES
METHUSELAH FUND
Celgene
SYNTHETIC GENOMICS
THE LONGEVITY FUND
SPHERA ASPIRE HIGHER
DRAPER FISHER JURVETSON
First Analysis Securities Corporation
THIEL
JUVENESCENCE
ARKIN HOLDINGS

P4 Medicine

JENNISON ASSOCIATES
RAMIUS A Cowen Group Company
ARCH Venture Partners
CIRM CALIFORNIA'S STEM CELL AGENCY
CASDIN CAPITAL
F/PRIME
SANOFI-GENZYME BIOVENTURES
Fidelity INVESTMENTS
alsFINDINGaCURE
ATEL Ventures, Inc.
illumina
OS FUND
CYBERDYNE
#ANGELS
FORBION Capital Partners
CEDARS-SINAI
formation 8
ND
T.RowePrice
General Catalyst Partners
khosla ventures
FLAGSHIP PIONEERING SCIENTIFIC VENTURES FOR LIFE
FLAGSHIP PIONEERING SCIENTIFIC VENTURES FOR LIFE
TELEGRAPH HILL PARTNERS
vertex VENTURES
SRIW INVESTMENT & GROWTH
WuXi Healthcare Ventures
RACAPITAL
LYZZ CAPITAL
EssexWoodlands
TORAY Toray Engineering Co.,Ltd.
De Novo VENTURES
VERSANT ventures
G/
TECHAMMER
THIRD ROCK VENTURES
Springboard Capital The Lending Hand
MAYO CLINIC VENTURES
LabCorp
TVM Capital HEALTHCARE PARTNERS
PARTNERS HEALTHCARE
TVM
venrock
brainchild
SUTTER HILL VENTURES
OMEGA FUNDS
Viking
WARBURG PINCUS
SWMF LIFE SCIENCE FUND
POLARIS PARTNERS

Top Longevity Venture Firms: Landscape

AgeTech

PRIMETIME PARTNERS
Maverick Ventures
MV
RISE OF THE REST
500
SV HEALTH INVESTORS
GENERATOR VENTURES
echo INNOVATION ALLIANCE
Ziegler
AXA Venture Partners
G/
LIFEFORCE CAPITAL
THE CARLYLE GROUP
STONEHENGE GROWTH EQUITY PARTNERS
4Gen ventures
SIERRA VENTURES
JK&B CAPITAL

FemTech

ARBORETUM VENTURES
BOX GROUP
ASTIA ANGELS
500
CORRELATION VENTURES
Rhia VENTURES
Y
astarteventures
FOUNDERS FUND
CATALYST HEALTH VENTURES
SLOW VENTURES
STEELSKY VENTURES

Longevity NeuroTech

Capricorn PARTNERS
Boston Scientific
G/
OrbiMed Healthcare Fund Management
bpifrance
ARCH VENTURE PARTNERS
Flagship Pioneering
EASME
FORBION Capital Partners
FORESITE CAPITAL
FOUNTAIN HEALTHCARE PARTNERS
GE Capital
GENERAL CATALYST
Johnson & Johnson
KLEINER PERKINS
LSP Life Sciences Partners
innovation works
LUX+
Medtronic
svb SiliconValley Bank
SOFINNOVA
TECH COAST ANGELS
THIRD ROCK VENTURES
STARTUP +HEALTH
VENTURE KICK
USVP/

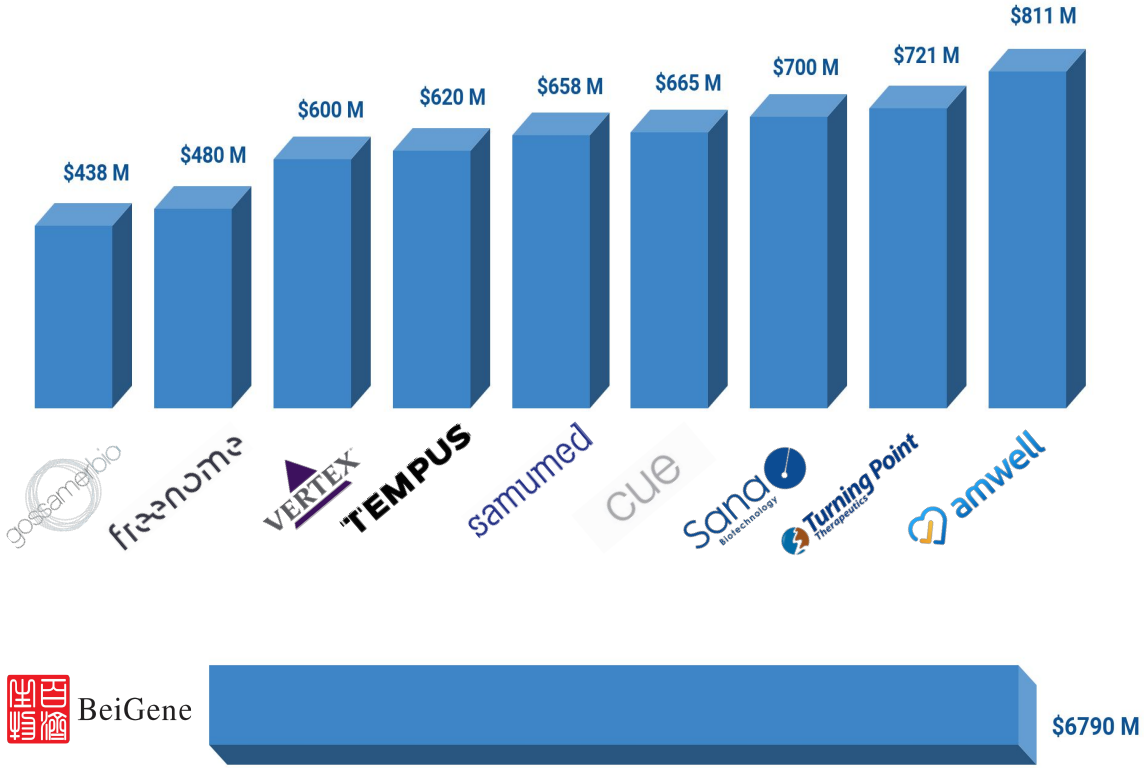
AI for Longevity

Flagship Pioneering
PSP Investments
LONGEVITY VISION FUND
Atinum INVESTMENT
JUVENESCENCE
THE LONGEVITY FUND
crv
innovation endeavors
NEUE FUND
PAVILION
G/
8∞
BOLD CAPITAL PARTNERS

Biomarkers for Longevity

polarispartners
G/
EcoR1 CAPITAL
TELEGRAPH HILL PARTNERS
XERAYA CAPITAL
BainCapital LIFE SCIENCES
NIH
PERCEPTIVE ADVISORS
echo INNOVATION ALLIANCE
FW Healthcare Partners
CAMBRIDGE INNOVATION CAPITAL
Pohne Capital
WuXi Healthcare Ventures
AURUM VENTURES
OrbiMed Healthcare Fund Management
ido INVESTMENTS

Top 10 Longevity-Focused Companies by Investment in 2020



The COVID-19 pandemic has boosted the growth of the biotech capital market and the development of the longevity sector (a 30% increase compared to the previous year).

Pandemic has stimulated an increase in investments in the longevity industry, where investments in 8 longevity-focused companies exceeded **$500 million in 2020**.

The list of **the most significant longevity-focused companies** by total investments includes::

- BeiGene;
- Amwell;
- Turning Point Therapeutics;
- Sana Biotechnology;
- Cue;
- Samumed;
- Tempus;
- Vertex Pharmaceuticals;
- Freenome;
- Gossamer Bio.

www.aginganalytics.com/longevity-investment-dashboard

50 Leading Companies in Longevity Sector

1	Abcam
2	AgeX Therapeutics
3	Alector
4	Alkahest
5	Alzheon
6	Amwell
7	Ascentage Pharma
8	Biophytis
9	Birdie
10	BlueRock Therapeutics
11	Caribou Biosciences
12	Celularity
13	Decibel Therapeutics
14	Deep Longevity
15	Denali Therapeutics
16	EarlySense
17	Elevian
18	Elysium
19	Epirium Bio
20	Freenome
21	Geron
22	Haunt.AI
23	Herophilus
24	Horizon Discovery
25	Human Longevity

50 Leading Investors in Longevity Sector

26	Insilico Medicine
27	Juvenescence
28	Krydel
29	Life Biosciences
30	LyGenesis
31	Magnetic Insight
32	Mammoth Biosciences
33	Mesoblast
34	Navitor Pharmaceuticals
35	Nectarine Health AB
36	Neuraly
37	Neurotrack
38	Nuritas
39	Oisin Biotechnologies
40	One Medical
41	Osiris Therapeutics
42	PharmEasy
43	Reven Pharmaceuticals
44	Samumed
45	Sana Biotechnology
46	SomaLogic
47	Spring Discovery
48	Underdog Pharmaceuticals
49	UniQure
50	UNITY Biotechnology

Top Longevity Companies by Sectors

AgeTech

one medical
amwell
birdie
Kraydel
alcove
妙手医生 miaoshou.net
tigerconnect
TELADOC.
greatcall
lifted
Cera We Care Better.
EarlySense
soundmind

AI for Longevity

YOUTH LABORATORIES
DEEP LONGEVITY
Valo
mission bio
eterly
Haut.AI
kaia health
Viz.ai
INSILICO MEDICINE
FABRIC GENOMICS
SPRING DISCOVERY
mmg
NEUROMATION
Sana Biotechnology
DYNO THERAPEUTICS
Elevian

FemTech

Radius
kindbody
elvie
Clue
Flo
Tia
oviahealth
Moody Month
LactApp
avaa
Bonzun
CORA
FERLY

Longevity NeuroTech

Sage Therapeutics
INSIGHTEC
Medtronic
nevro
cerevel
CORTEXYME
DENALI THERAPEUTICS
Axonics
sosei HEPTARES
NEUROPACE
relievant medsystems
COMPASS Navigating Mental Health Pathways
saluda MEDICAL
TR TauRx Pharmaceuticals Innovation in neurodegeneration
NEURALINK
Prevail THERAPEUTICS
CXGRX

Top Longevity Companies by Funding Level and Specialization

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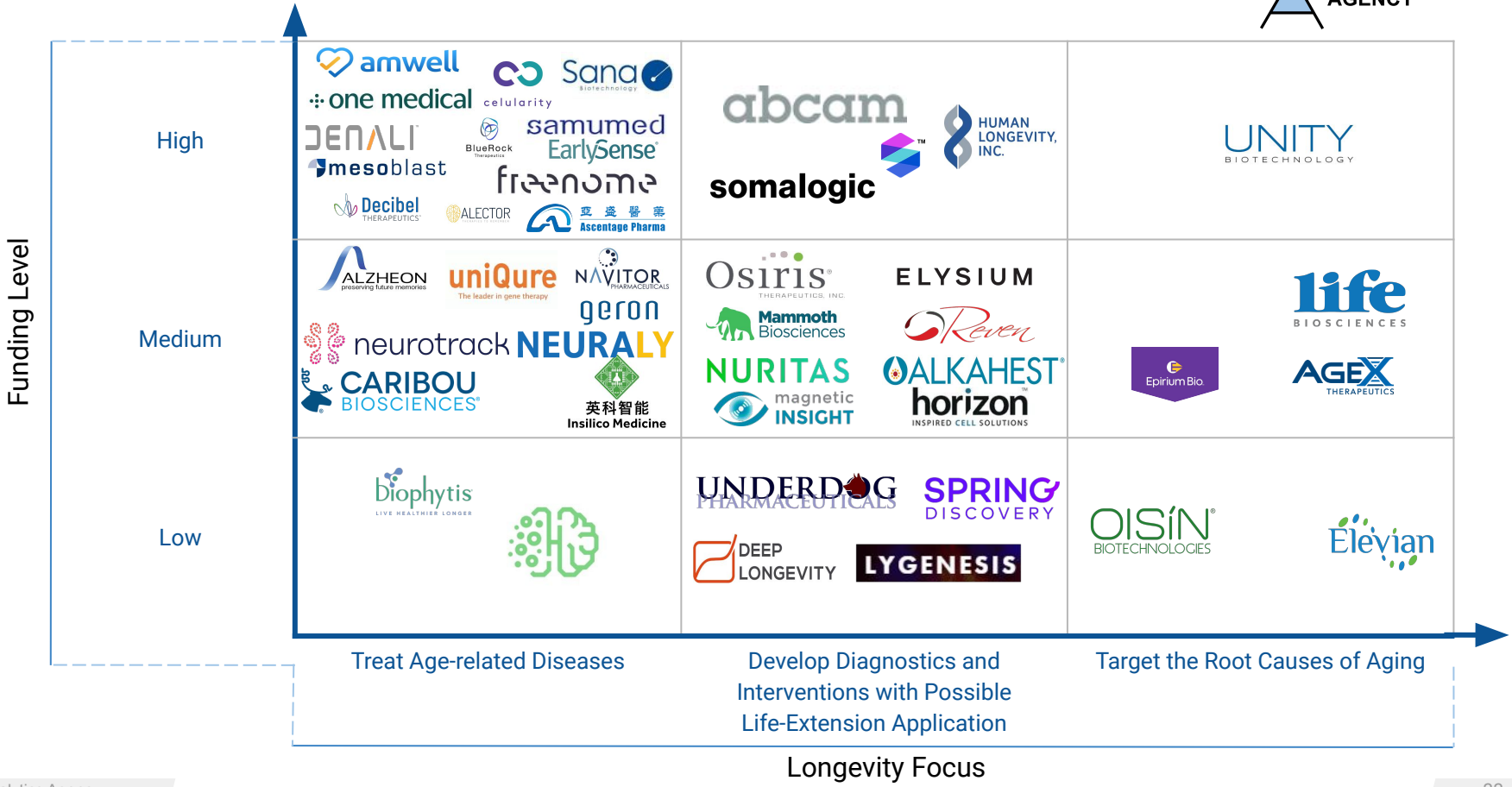


Top Longevity Companies by Funding Level and Specialization

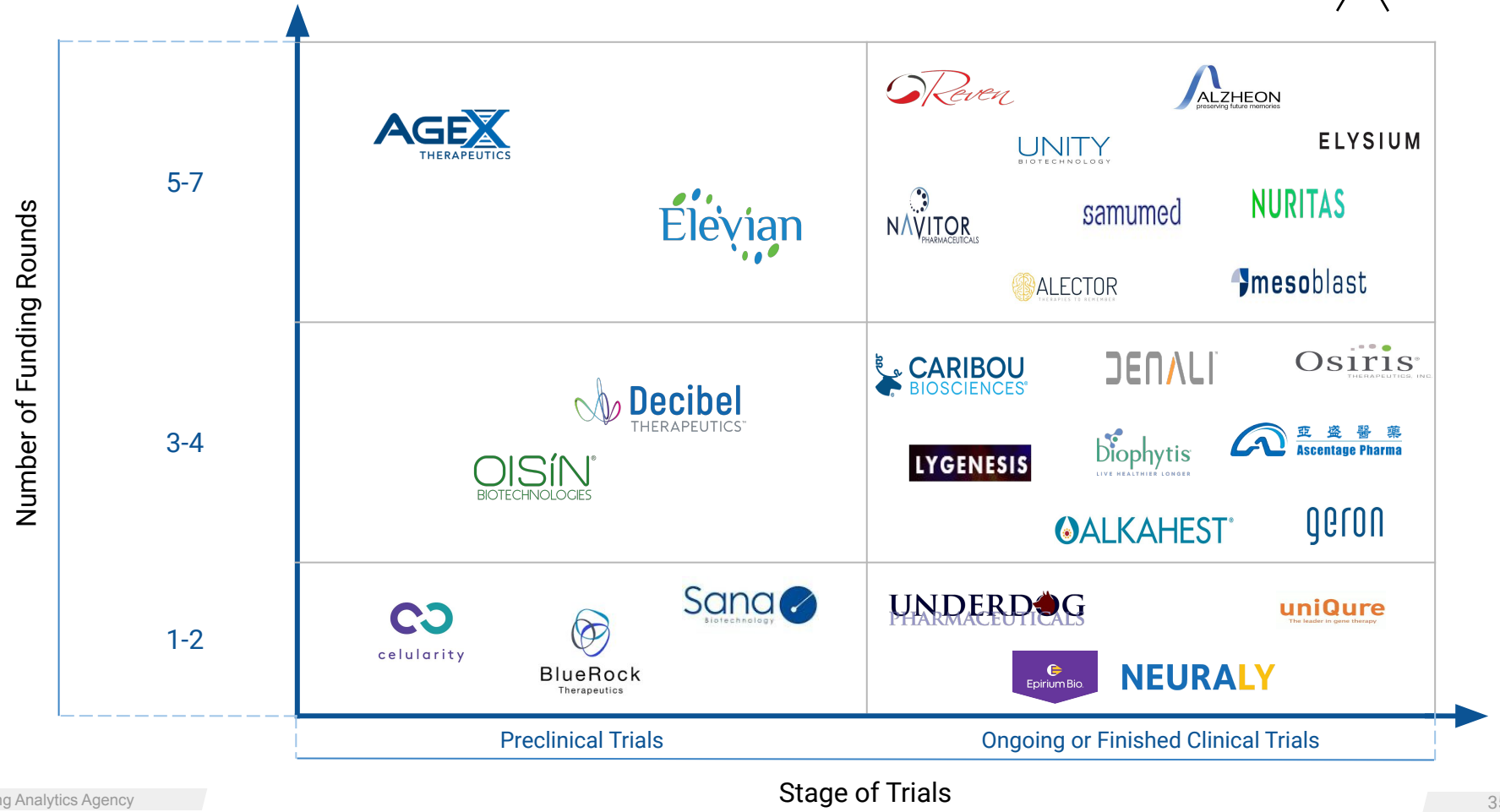
AGING ANALYTICS AGENCY

Funding Round	Small Molecules/ Biologics	Gene Therapy	Cell Therapy
IPO	ALECTOR, biophytis, UNITY BIOTECHNOLOGY, DENALI, geron	uniQure (The leader in gene therapy)	AGEX THERAPEUTICS, mesoblast
Rounds C-F	samumed, Reven, 亞盛醫藥 Ascentage Pharma, ELYSIUM	Decibel THERAPEUTICS	UNITY BIOTECHNOLOGY
Round B	英科智能 Insilico Medicine		CARIBOU BIOSCIENCES, Osiris THERAPEUTICS, INC.
Round A	ALKAHEST, Elevian, Epirium Bio, NEURALY, NURITAS, Sana biotechnology, NAVITOR PHARMACEUTICALS, ALZHEON preserving future memories	OISIN BIOTECHNOLOGIES	BlueRock Therapeutics, LYGENESIS, celularity
Seed	UNDERDOG PHARMACEUTICALS		

Type of Treatment

Top Longevity Companies

AGING ANALYTICS AGENCY



Top Longevity Companies

AGING ANALYTICS AGENCY

Funding Level	Small Molecules/Biologics	Gene Therapy	Cell Therapy
Clinical Trials	ELYSIUM, NURITAS, ALZHEON preserving future memories, ALECTOR, samumed, 亞盛醫藥 Ascentage Pharma, geron, ALKAHEST, NEURALY, Biophytis LIVE HEALTHIER LONGER, Epirium Bio, DENALI, UNDERDOG PHARMACEUTICALS, NAVITOR PHARMACEUTICALS, Reven, UNITY BIOTECHNOLOGY	uniQure The leader in gene therapy	mesoblast, Osiris THERAPEUTICS, INC., LYGENESIS, CARIBOU BIOSCIENCES
Preclinical Trials	Elevian	Decibel THERAPEUTICS, OISIN BIOTECHNOLOGIES	AGEX THERAPEUTICS, celularity, BlueRock Therapeutics

Type of Treatment

Top Investors in the Longevity Industry

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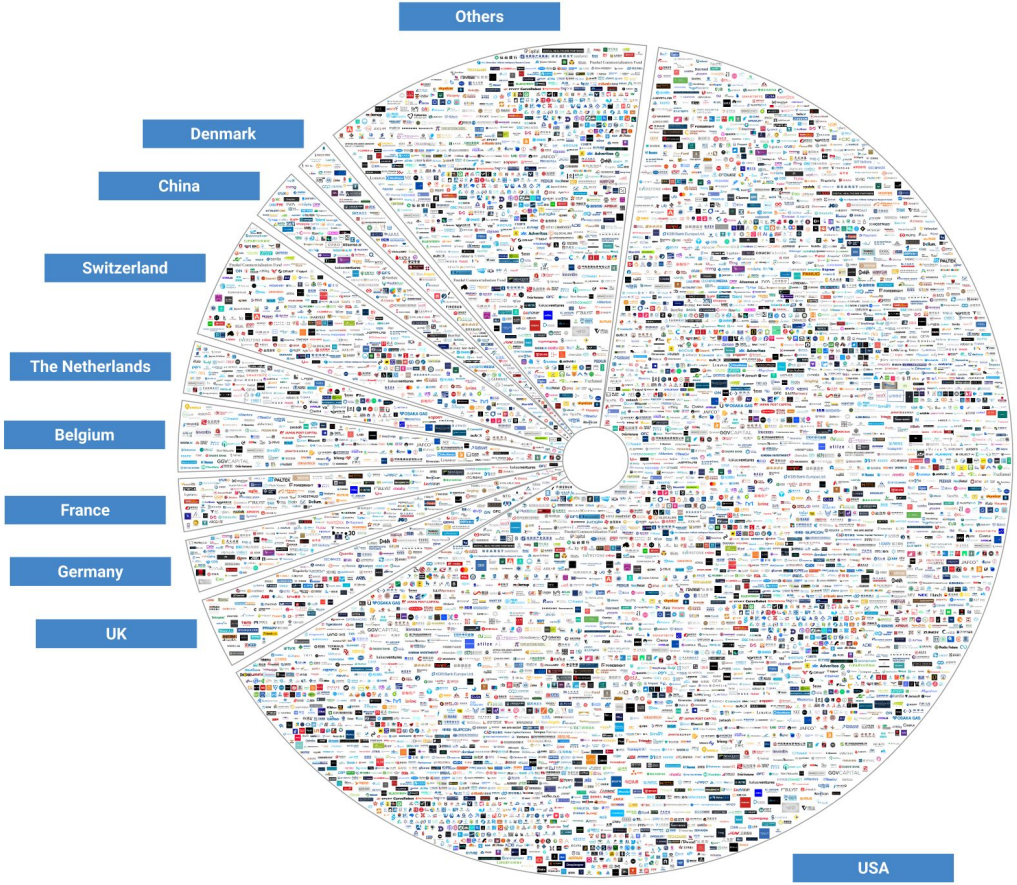
Longevity Investors Landscape by Country



Despite the considerable interest in longevity worldwide, **most investors** are still located in **the USA.**

The most active investors by number of investments are:

EU Executive Agency for SMEs - set-up by the European Commission to manage on its behalf EU programmes in the fields of energy, the environment, and business support. Location: European Union (EU).

Y Combinator - seed money startup accelerator launched in March 2005. Invested in more than 2000 companies. Location: Cambridge, Massachusetts.

Techstars - seed accelerator founded in 2006 in Boulder, Colorado. As of 2019, the company had accepted over 1,600 companies (combined MCap of $18.2bn USD).

500 Startups - 500 Startups is an early-stage venture fund and seed accelerator. Location: San Francisco, California.

SOSV - venture capital and investment management firm that provides seed, venture and growth stage funding to technology startups. Location: Princeton, New Jersey.

50 Leading Investors in Longevity Sector

1	500 Startups
2	Advent Life Sciences
3	Apollo Ventures
4	ARCH Venture Partners
5	Berkeley SkyDeck
6	Bill & Melinda Gates Foundation
7	Bold Capital Partners
8	Celgene
9	Clarus Ventures
10	CRG L.P.
11	Deep Knowledge Ventures
12	Eight Roads Ventures
13	Esas Ventures
14	Essex Woodlands Health Ventures
15	F-Prime Capital
16	Flagship Pioneering
17	Forbion Capital Partners
18	Foresite Capital
19	Formic Ventures
20	Founders Fund
21	GE Capital
22	GV
23	Illumina
24	Index Ventures
25	Innovate U.K.

50 Leading Investors in Longevity Sector

26	Jefferson Health System
27	Juvenescence
28	KIZOO Technology Capital
29	Longevity Vision Fund
30	MassChallenge
31	Maverick Ventures
32	Methuselah Fund
33	National Institutes of Health
34	Novartis
35	Novartis Venture Fund
36	Novo Holdings
37	Omega Funds
38	OrbiMed
39	Pitch@Palace
40	Polar Light Ventures
41	Polaris Partners
42	RA Capital Management
43	Roche Venture Fund
44	Social Capital
45	SR One
46	StartX (Stanford-StartX Fund)
47	The Longevity Fund
48	Venture Kick
49	VI Partners
50	Vickers Venture Partners

Comparison of Longevity Investment Funds
Research Focus / Investment Portfolio Focus

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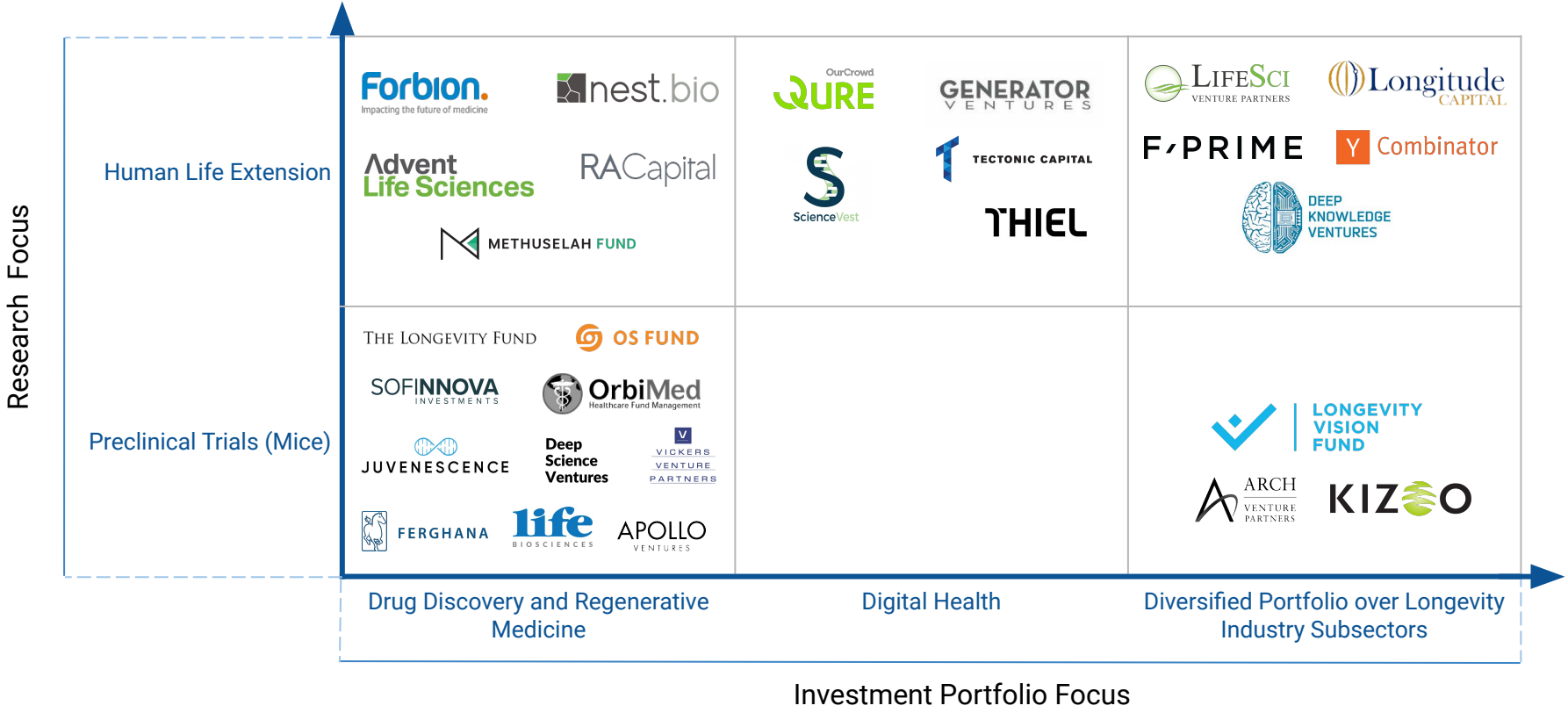

Comparison of Longevity Investment Funds
Funding Round Focus / Company Stage Focus

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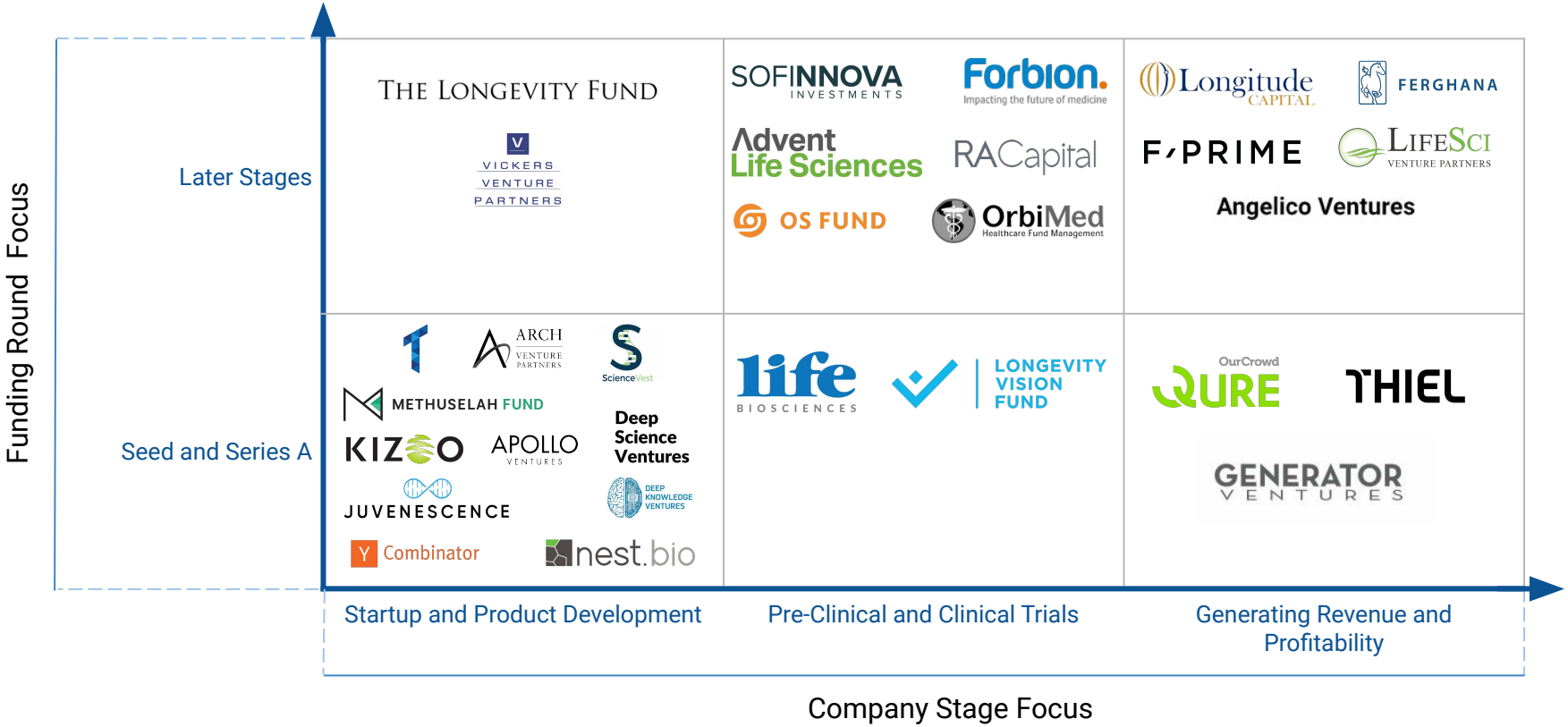

Comparison of Longevity Investment Funds
Investment Specialization / Investment Approach

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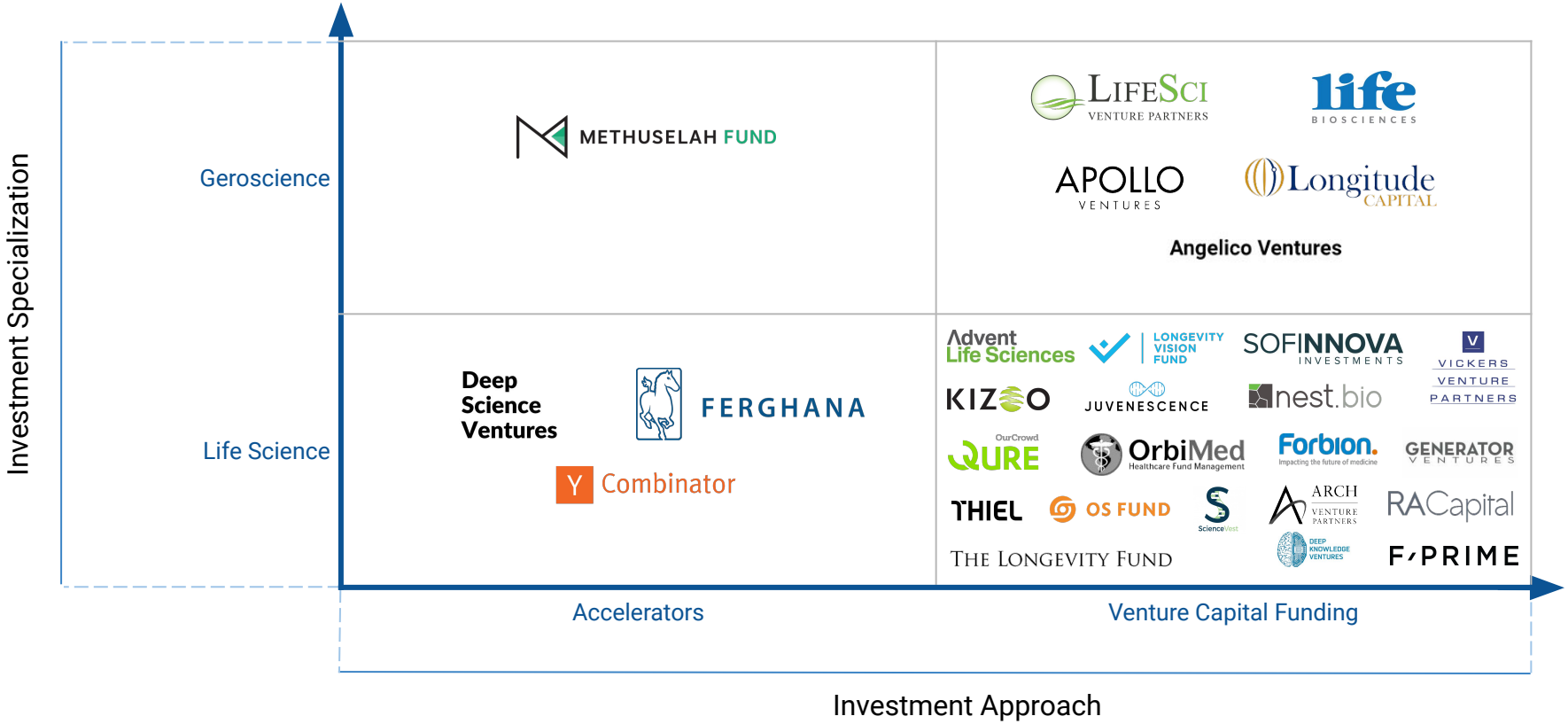

Comparison of Longevity Investment Funds
Number of Investments / Geographical Distribution of Assets

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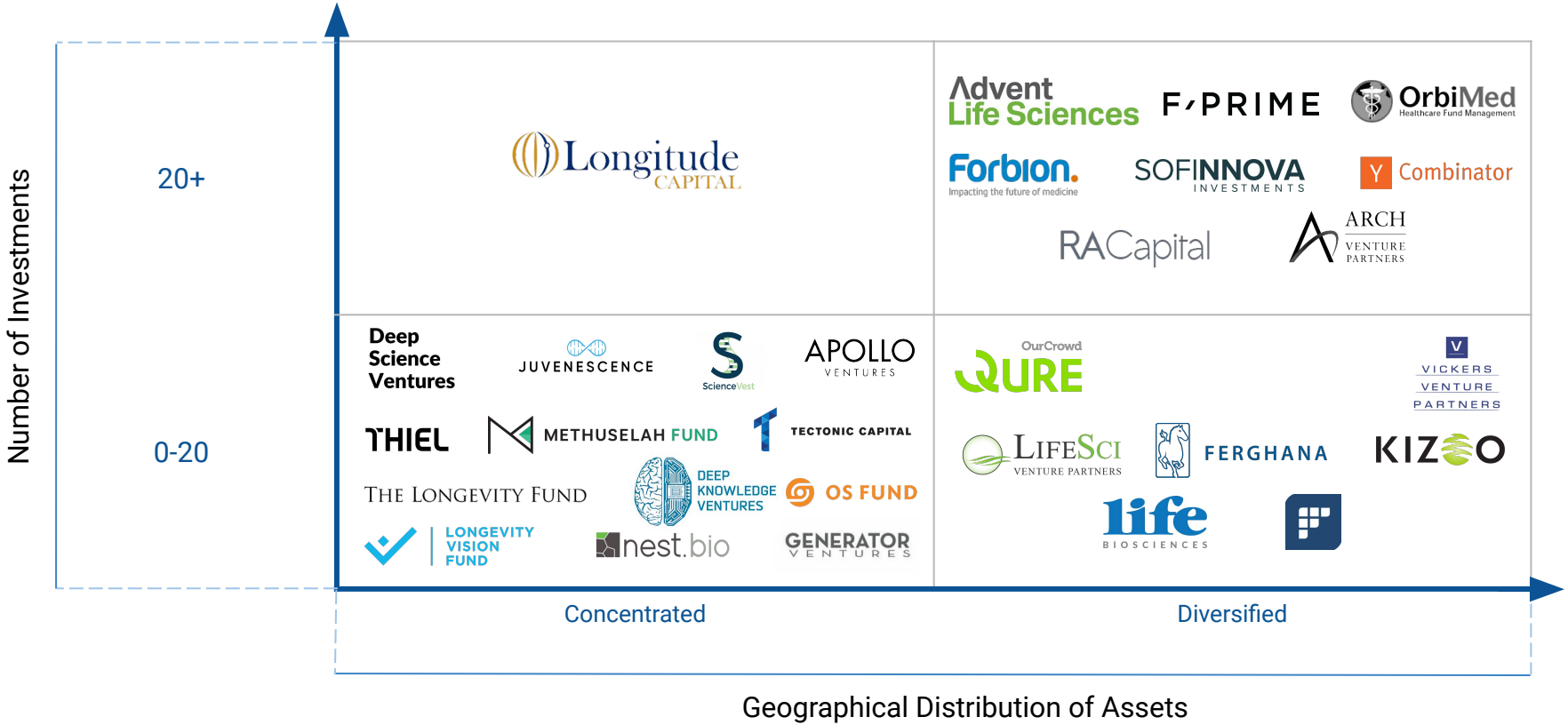
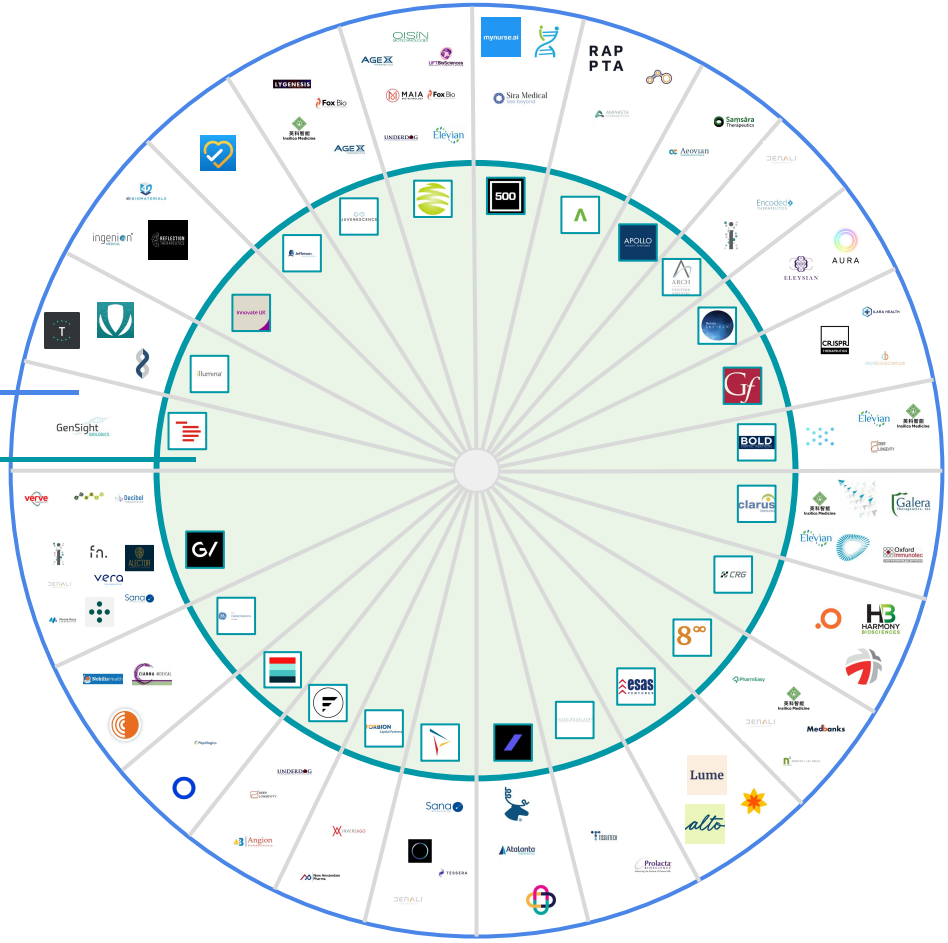


Top Investors in the Longevity Sector (Part 1)

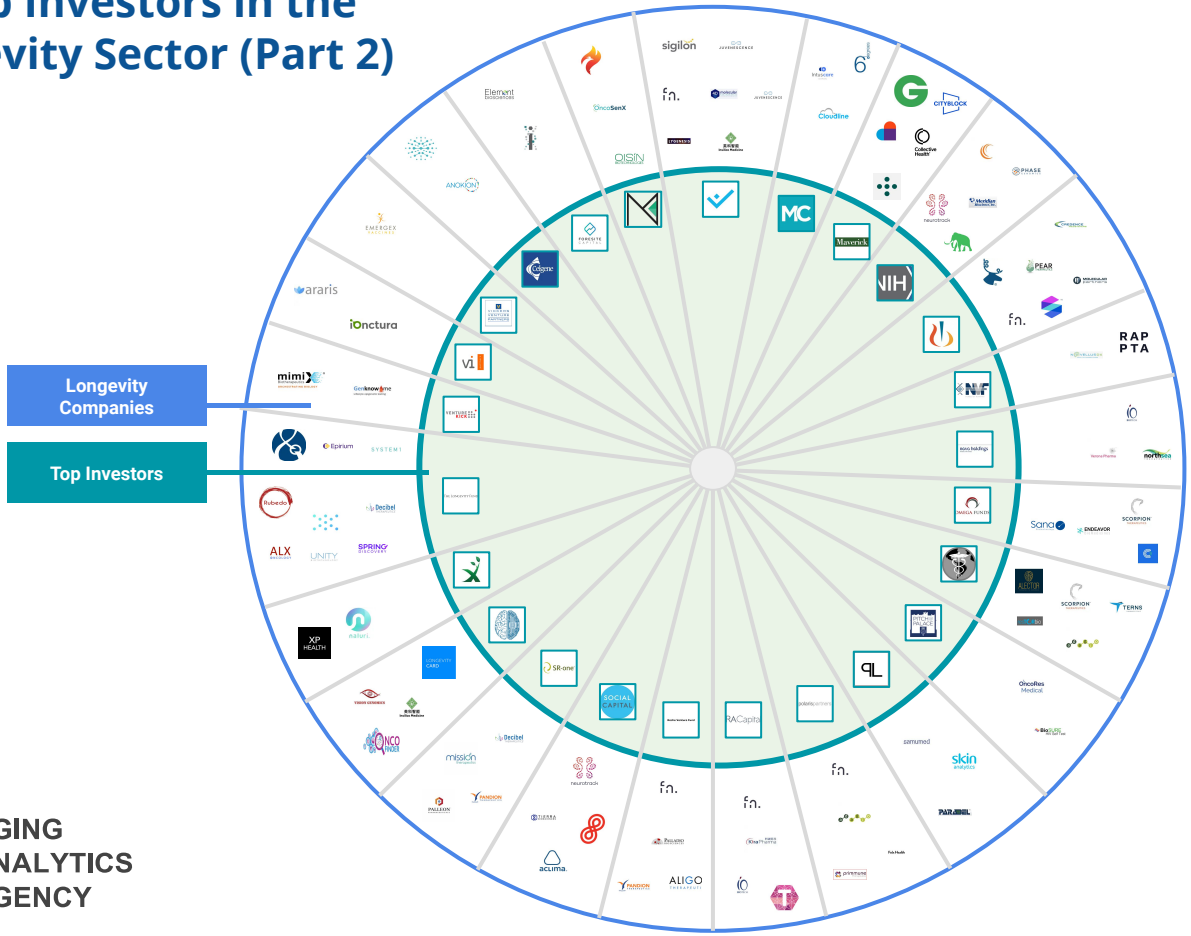
Portfolios of leading biotech investors include startups from the list of Top-50



AGING ANALYTICS AGENCY

50 Top Investors in the Longevity Sector (Part 2)

Portfolios of leading biotech investors include startups from the list of Top-50



AGING ANALYTICS AGENCY

50 Top Investors in the Longevity Sector

Longevity Companies	Top Investors	Longevity Companies
RAPPTA	500	mynurse.ai
Encoded	APOLLO	Samsara Therapeutics, Aeovian
CRISPR		AURA, ELEYSIAN
Galera, Oxford Immunotec, Elevian	clarus, BOLD	Elevian
PharmEasy, Medbanks	CRG	HARMONY, HB
Prolacta	esas	alto, Lume
Sana, TESSERA		Atalanta, ADP
UNDERDOG, Angion	GRAIL	
vera, ALECTOR, Sana, Decibel	G/	GenSight, verve
ingenion	illumina	
LYGENESIS, Fox Bio, AGEX		
AGEX, UNDERDOG, MAIA, OISIN, Fox Bio, Elevian		

Longevity Companies	Top Investors	Longevity Companies
neurotrack, Meridian Biosciences, PHASE	Maverick	Collective Health, CITYBLOCK
RAPPTA	NF	PEAR, CADENCE, MOLECULAR
Sana, ENDEAVOR, SCORPION		northsea
OncoRes Medical, TERNS		ALECTOR, SCORPION
skin analytics, PARABEL		primmune
	RACapital	PANDION, PALLADIO, ALIGO
aclima, neurotrack	SOCIAL CAPITAL, SR-one	PALLION, mission, PANDION, Decibel
XP HEALTH, naluri		Rubedo, ALX, UNITY, Epirium, SPRING, Decibel
Oncturo	vi	mimi, araris
ANOKION	Cogent	EMERGEX
OncoSenX		Element BioSciences
Cloudline	MC	LYGENESIS
	August Capital	

Longevity Industry Market Timeline

The first approaches — 2013-2015

- The first scalable approaches for longevity biomedicine and biomarkers of ageing were developed and several industry players with forward-thinking executives started launching pilot collaborations and making small investments.
- However, only few market players believed in anti-aging technologies.

Criticism — 2016-2017

- Many pilot projects failed due to the lack of scientific validation and immaturity of the technologies, creating a lot of criticism towards the whole industry.
- Since then the race for the acquisition of the longevity startups began.
- Testing of the technology began.

Industry development — 2018

- Capitalization of the industry was continuously growing.
- Many bets of early investors appeared to be justified.
- Large financial institutions, as well as government agencies, started to express interest in the longevity industry.

Transition from quantity to quality — 2019

- It was an important milestone in transitioning from the quantity of longevity startups,, investments, and M&As to qualitative gains — significant number of practical validations of previously conducted research appeared during this year.
- Competition for the most successful pharma AI companies increased dramatically.

Intensive competition — 2020-2021

- Most developed longevity startups are becoming mature companies, large institutional investors are being attracted to the industry, full-fledged longevity infrastructure is being developed.
- Intensive cooperation of longevity companies with corporations, banks, and governments begins.
- Competition among advanced longevity companies booms.

Conclusions

I. Most of longevity-focused investment funds invest in drug discovery and depend on the success of clinical trials

Longevity-focused investment funds follow a strategy whereby they invest in one another, drug discovery and AI-driven pharma companies. Investors are highly exposed to risks associated with drug failure because most of portfolio drug discovery companies specialize in animal clinical trials. Animal models have limited concordance with human pathology. A molecule that extends a healthy lifespan in one species often extends a lifespan in other species. To minimize the risk of failed clinical trials and increase the probability of successful commercialization of treatment, researchers should determine the effects of the drug on the human body, assess its dosage and safety, and obtain a safe and optimal dosage that is likely to be effective for the proposed indication.

II. Lack of portfolio diversification over Longevity industry subsectors

Although venture funds by definition are supposed to prioritize investments into the most disruptive technologies and startups, most of them actually prefer to specifically avoid DeepTech sectors or enter investment rounds at later stages. **Longitude Capital, F-Prime Capital** and **LifeSci Venture Partners** have a sufficiently diversified investment portfolio both by longevity subsectors and by the level of companies' maturity. They prefer to invest in AgeTech, Drug Discovery, and P4 Medicine projects at different funding stages.

III. Lack of effective de-risking investment strategies in terms of "time diversification" and company stage

The majority of longevity-focused funds (e.g. KIZOO, Apollo Ventures, and Juvenescence) are early-stage investors, which are exposed to critical investment risks. They understand that building a new business takes time and ongoing support, so they typically expect to make multiple investments in a single company as it develops. The challenge is to design de-risking strategy that can cost-effectively catalyze private investment and deliver a successful outcome of every portfolio project.

IV. The Longevity industry will inevitably exhibit growth

It is beneficial for investors, as it accelerates their access to biomedical technology and life extension. It is of great benefit to humanity, creating the products and services that will help us enter a new era of long, comfortable and productive lives. Being the most ethical way of conducting business, it also helps generate enormous profits, contributes to the development of the most advanced longevity technologies, and makes humanity healthier.

Longevity Investment: Big Data Analytics Dashboard

Longevity Governance and National Healthcare Budgets

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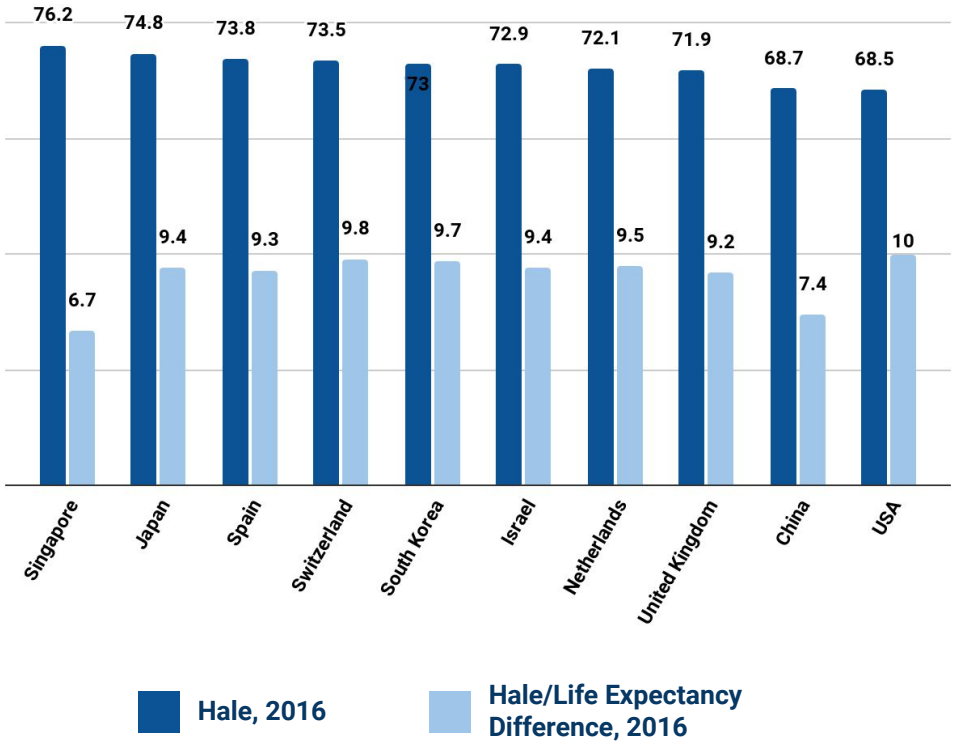
Longevity Governance Industry: Overview



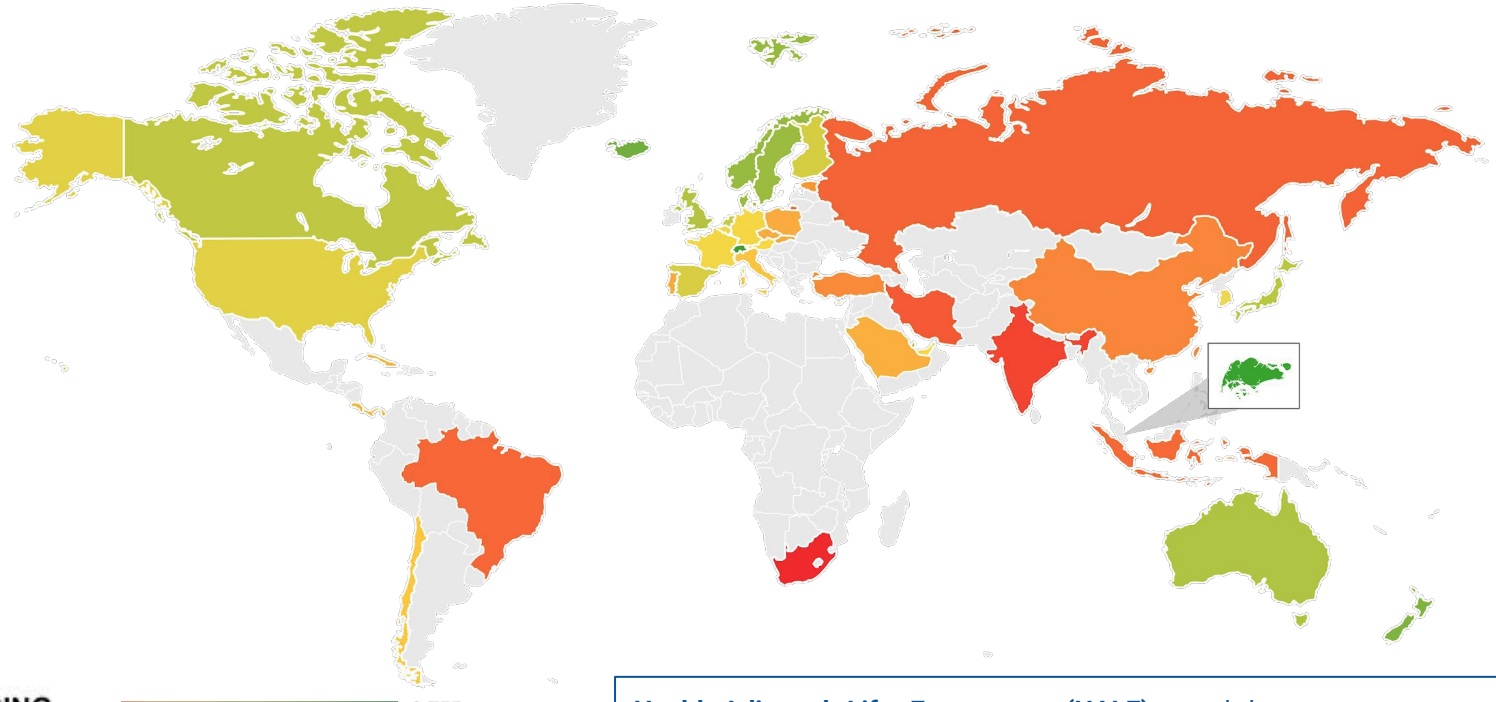
The main goal of the Longevity Governance Industry is to **reduce the gap between life expectancy and HALE** (Health-Adjusted Life Expectancy). Global Longevity Governance is a special analytical study that uses data across 50 countries to measure Healthy Longevity according to HALE. In so doing, it is able to identify the existing gaps between HALE and unadjusted life expectancy. All the parameters used in the report depend on the social policy, healthcare, medical, financial and socio-economic factors in a particular country. We provide an overview of countries with the lowest to highest HALE indicators.

The lowest gap between HALE and Life Expectancy is observed in **Singapore** where people tend to be wealthier and are, therefore, able to eat healthy food and have access to the best health care. However, this rule is not applicable to **the US**, which spends a significant amount of money on health care but still has a relatively low HALE. Countries in which people live in poor environmental conditions, do not have access to modern healthcare and eat poor-quality food also have a low HALE.

50 Countries: Analysis of Longevity Progress

1	Argentina
2	Australia
3	Austri
4	Belgium
5	Brazil
6	Canda
7	Chile
8	China
9	Costa Rica
10	Cuba
11	Czech Republic
12	Denmark
13	Estonia
14	Finland
15	France
16	Germany
17	Greece
18	Hong-Kong, SAR
19	Iceland
20	India
21	Indonesia
22	Iran
23	Ireland
24	Israel
25	Italy
26	Japan
27	Luxembourg
28	Malta
29	Mexico
30	Netherlands
31	New Zealand
32	Norway
33	Panama
34	Poland
35	Portugal
36	Qatar
37	Republic of Korea
38	Russian Federation
39	Saudi Arabia
40	Singapore
41	Slovakia
42	Slovenia
43	South Africa
44	Spain
45	Sweden
46	Switzerland
47	Turkey
48	United Arab Emirates
49	United Kingdom
50	United States of America

HALE Ranking and Gap Estimation



0.755

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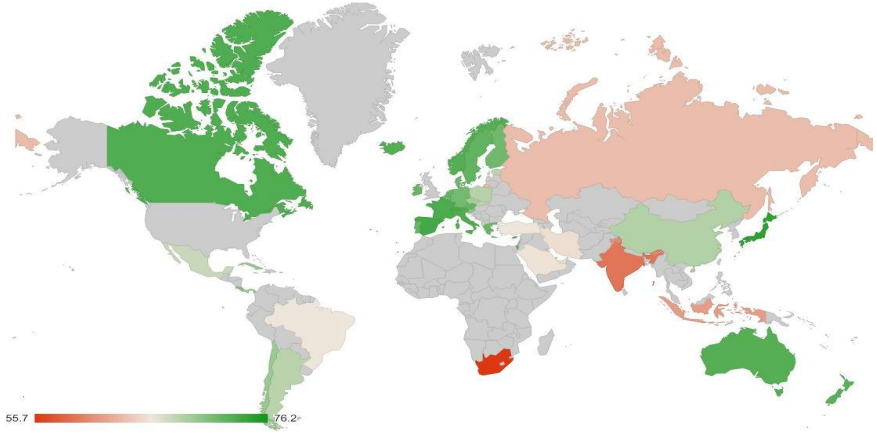
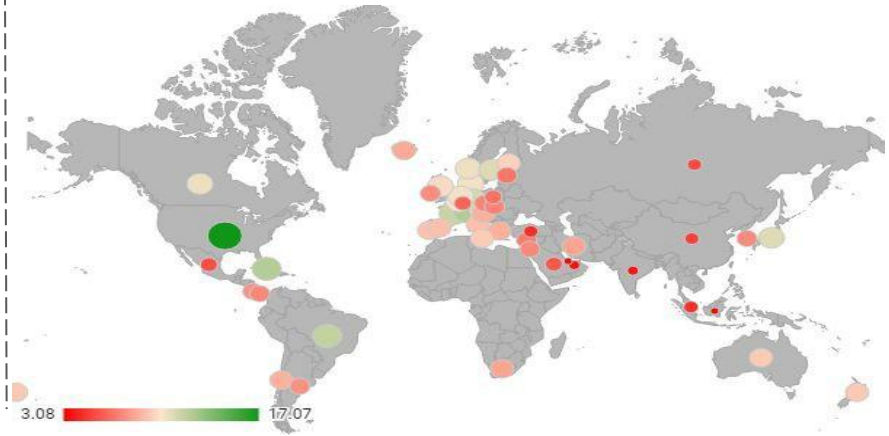
Health-Adjusted Life Expectancy (HALE), used here as a measure of Healthy Longevity, is the average number of years an individual can expect to live free of chronic age-related disease.

HALE and Life Expectancy: Factors Affecting HALE

Both Sexes HALE



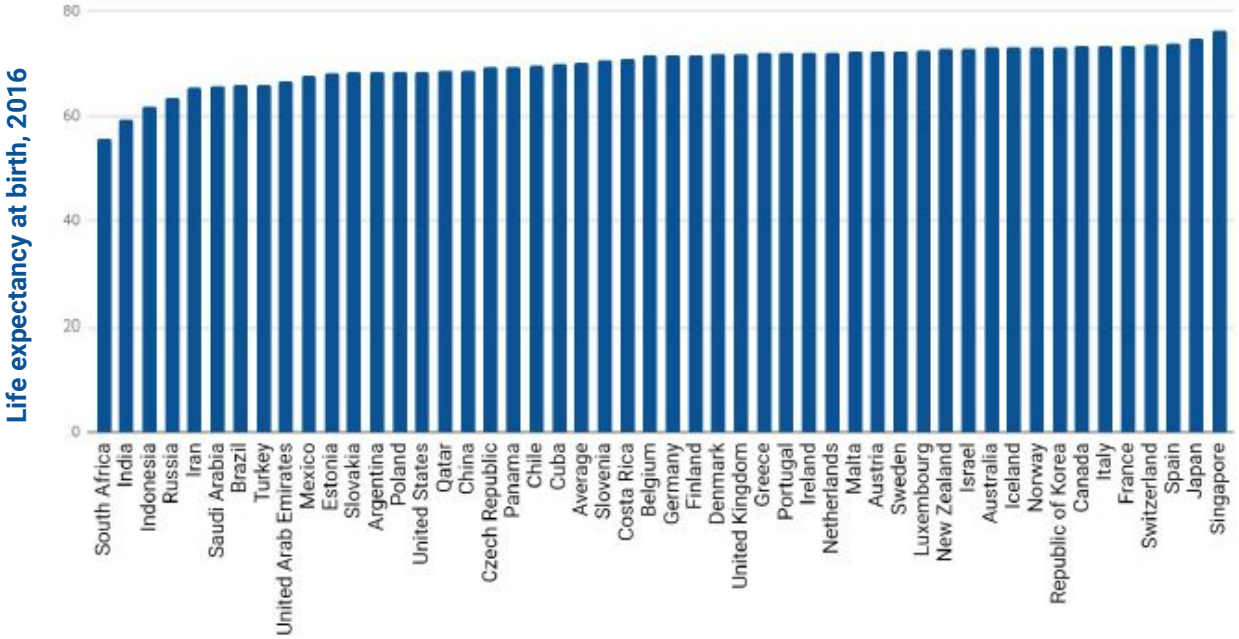
Public Health Expenditure (as % of GDP)



Being a major characteristic of a country's healthcare policy, public health expenditure is, therefore, a key variable as far as the research purpose is concerned. There is a wide variation in the percentage of public healthcare expenditure across different countries, which reflects profound differences in their healthcare systems. Hence, public spending on healthcare affects the latter's efficiency than being an input in the health production function.

Efficiency of a healthcare system cannot be measured by health expenditure as percentage of GDP Health expenditure involves consumption of healthcare goods and services, including personal healthcare and collective services. It is a complex indicator that varies across different countries. Healthcare spending in developed countries is impacted by higher prices, as well as higher administrative and transaction costs. That is precisely why increased healthcare spending does not always result in a more efficient healthcare system and better health of a country's citizens.

Health-Adjusted Life Expectancy at birth



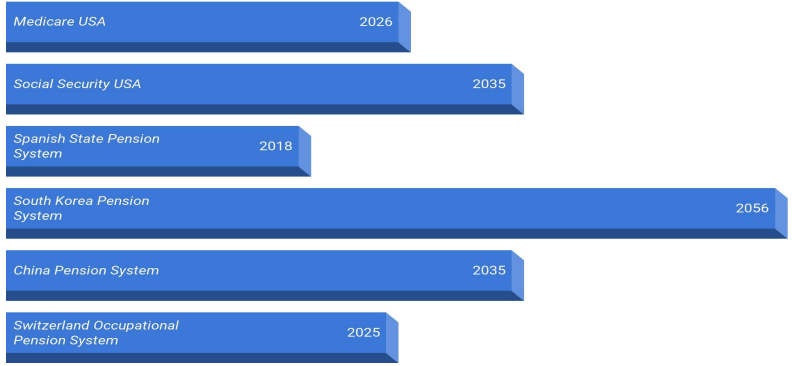
Developed countries have higher health-adjusted life expectancy comparing to developing countries. HALE at birth in countries varies significantly. The highest value is in Singapore and the lowest value is in South Africa, they equal 76.2 and 55.7 years accordingly. The United States is the high-income country where life expectancy is marginally low the average level of chosen countries (70 years). Poland has the lowest HALE among European Union countries presented in the report.

Singapore's Health Care System is More Efficient, Affordable and Quality Than That of the US

The United States spends a disproportionate amount on health care, comparing to Singapore, but HALE is relatively low

Singapore	United States
HALE: 76.2	HALE: 68.5
HALE GAP: 6.7	HALE GAP: 10.0
Life Expectancy: 82.9	Life Expectancy: 78.5
Healthcare Efficiency Rank: #2	Healthcare Efficiency Rank: #25
Healthcare Spending: 4.5% GDP	Healthcare Spending: 18% GDP

Insolvency Predictions for Government-Funded Schemes



As of 2017, Singapore spent much less on healthcare per capita than the US ($2,462 vs $10,224 respectively). However, Singapore citizens tended to spend more on health care than their US counterparts (31.17% vs 11.09% respectively). It is also worth pointing out that health care in Singapore is more affordable than in the US.

Unlike Singapore, the US is quite wasteful in its healthcare spending. About a quarter of its health care expenditure is associated with administrative costs, which is higher than in any other country. Another major difference between the US and other developed countries is medicine costs. Unlike in other countries where governments negotiate prices for medicines with medicine makers, Medicare Part D, an optional United States federal-government program, specifically forbids to negotiate medicine prices.

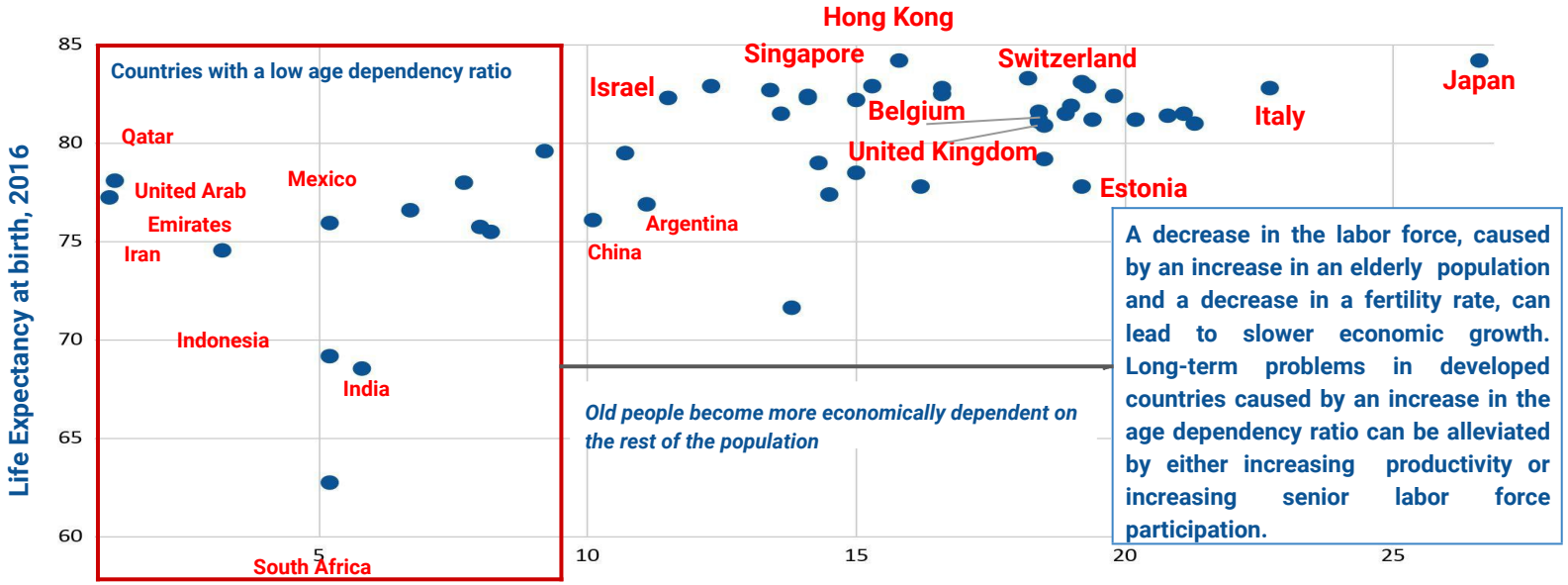
The big gap between life expectancy and health-adjusted life expectancy in the US is caused by a high health disparity between different income groups. Currently, the four leading causes of disease in the US are tobacco use, excessive use of alcohol, unhealthy diet, and physical inactivity. Also referred to as modifiable risk factors, they can lead to cardiovascular disease - the leading NCD in terms of premature deaths.

Singapore's Health Care System Beats Hong Kong's in its Efficiency and Affordability

Healthcare Outcomes Metrics (2016)			
Country	**Life Expectancy**	**Infant Mortality per 1 000 population**	**Maternal Mortality per 100 000 population**
Singapore	82.8	2.1	10.0
Hong Kong	84.2	1.5	1.8
Healthcare Spending & Affordability (2016)			
Country	**Government Health Spendings, %**	**Government Health Spendings, as % of Budget**	**Out-of-pocket Expenditure as % of GNI**
Singapore	54	14	1.5
Hong Kong	50	12	1.9
Healthcare Accessibility (2016)			
Country	**Doctors per 10 000 population**	**Nurses per 1 000 population**	**Hospital Beds per 1 000 population**
Singapore	23.1	7.1	2.5
Hong Kong	20.0	7.9	3.7

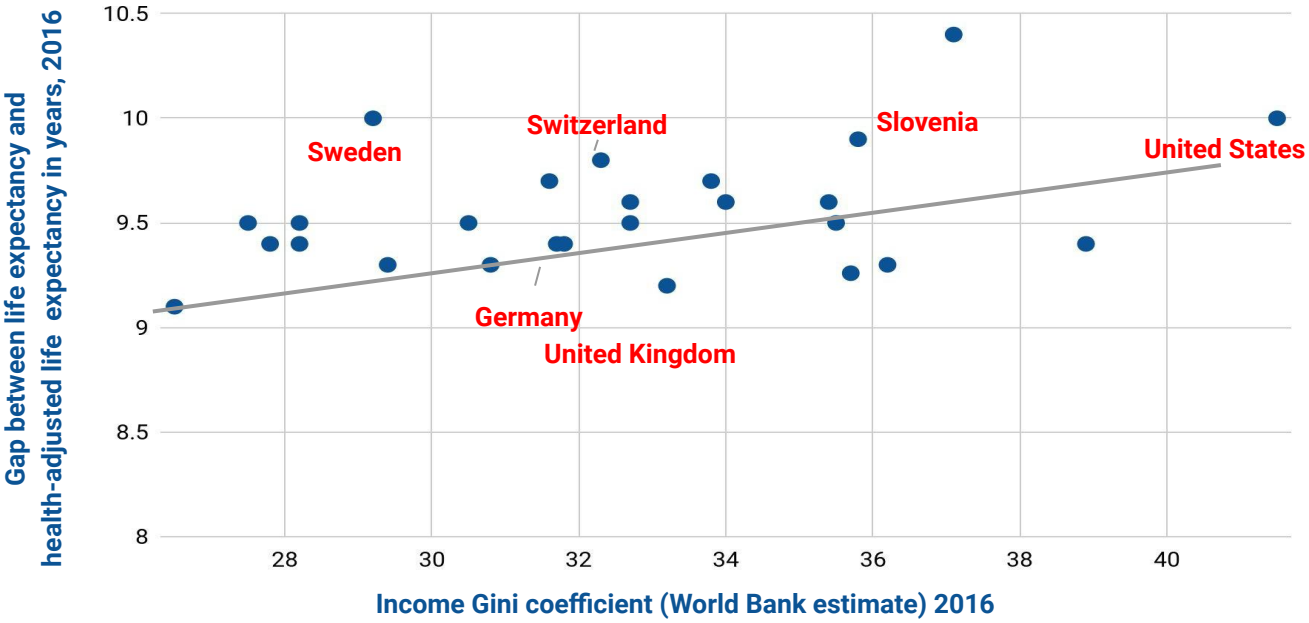
Both Singapore and Hong Kong citizens enjoy high-quality healthcare, live long lives and have low maternal and infant mortality rates. Singapore is known for having exceptional medical care and an enviable health insurance system. In contrast, Hong Kong has expensive private healthcare that is not affordable to lower income groups. Singapore has the 5th highest rate of physicians and nurses per capita, while Hong Kong faces shortage of qualified doctors and other health professionals in the public sector. In Hong Kong, senior citizens face significant difficulties in accessing primary healthcare services and are, therefore, particularly vulnerable.

Life Expectancy and Aging Population



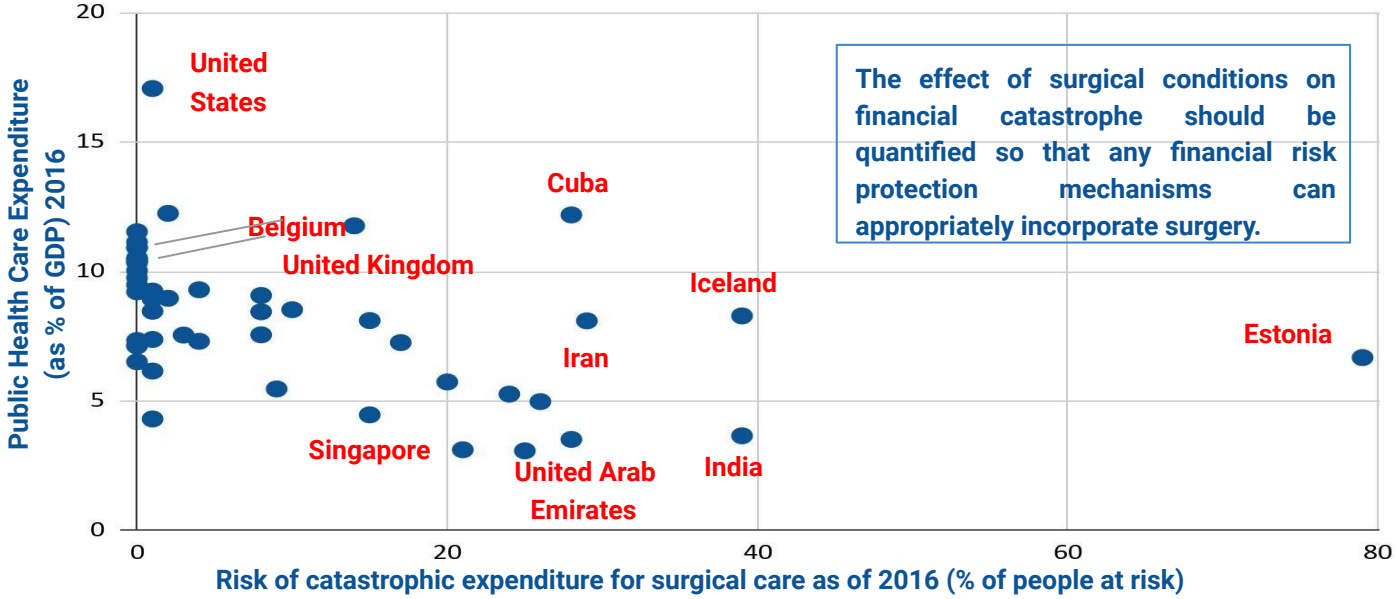
Life expectancy has been on the increase all around the world. Since the 1950s, the main factor contributing to a steady rise in life expectancy has been reduced mortality rates among senior citizens. It has contributed to the aging of the population and critical changes in age distribution. The aging population contributes to higher life expectancy and increases the gap between life expectancy and HALE. The major problem with increased life expectancy is that it also increases the morbidity rate: people live long enough to get more age-related diseases, disabilities, dementia, and other dysfunctions.

Life Expectancy and Aging Population



In countries where population size and income level are approximately the same, people tend to be aging more rapidly, with many of their citizens being over 65 years old. Life expectancy can be influenced by several factors: quality of the healthcare system (e.g., quality of care and access to preventive health services), economic, behavioral, and environmental factors that may be outside the control of the healthcare system (e.g., poverty, lifestyle, violence, and accidents). The rate of economic inequality in the U.S. is higher than in any other developed country. Unlike people with higher incomes, people with lower incomes are less likely to be in good health. There is also a growing disparity in life expectancy between representatives of low and high-income groups.

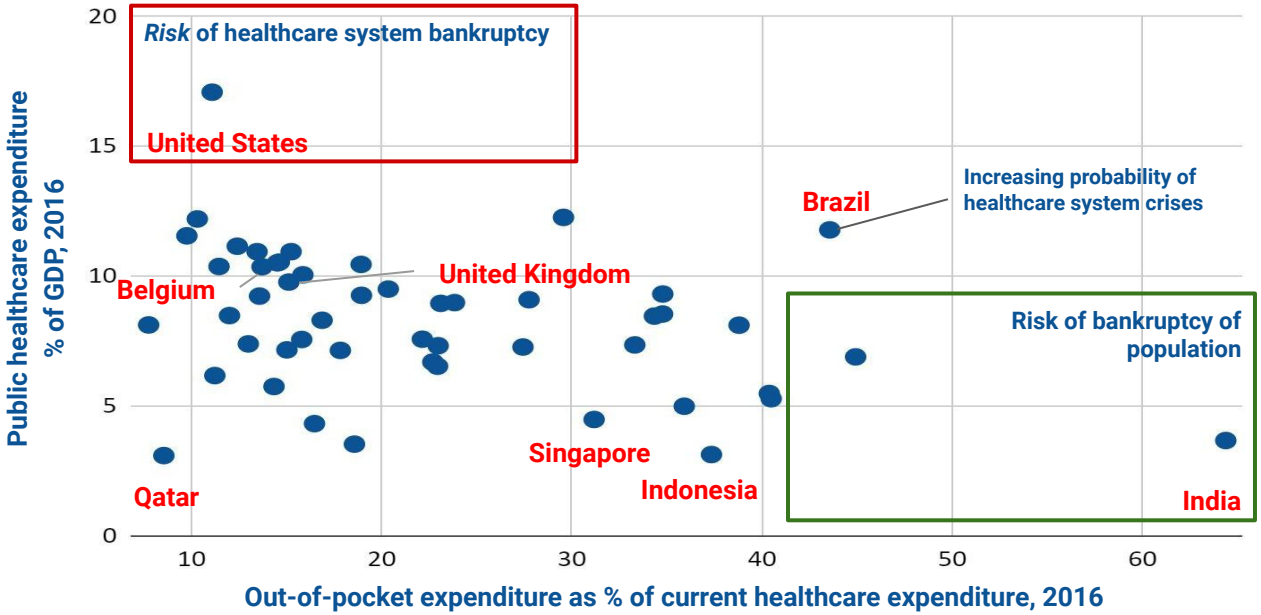
Risk of Catastrophic Expenditure for Surgical Care



It is the poor that bear the main brunt of catastrophic expenditure in low- and middle-income countries. Please note that estimates are sensitive to the definition of catastrophic expenditure and the cost of care.

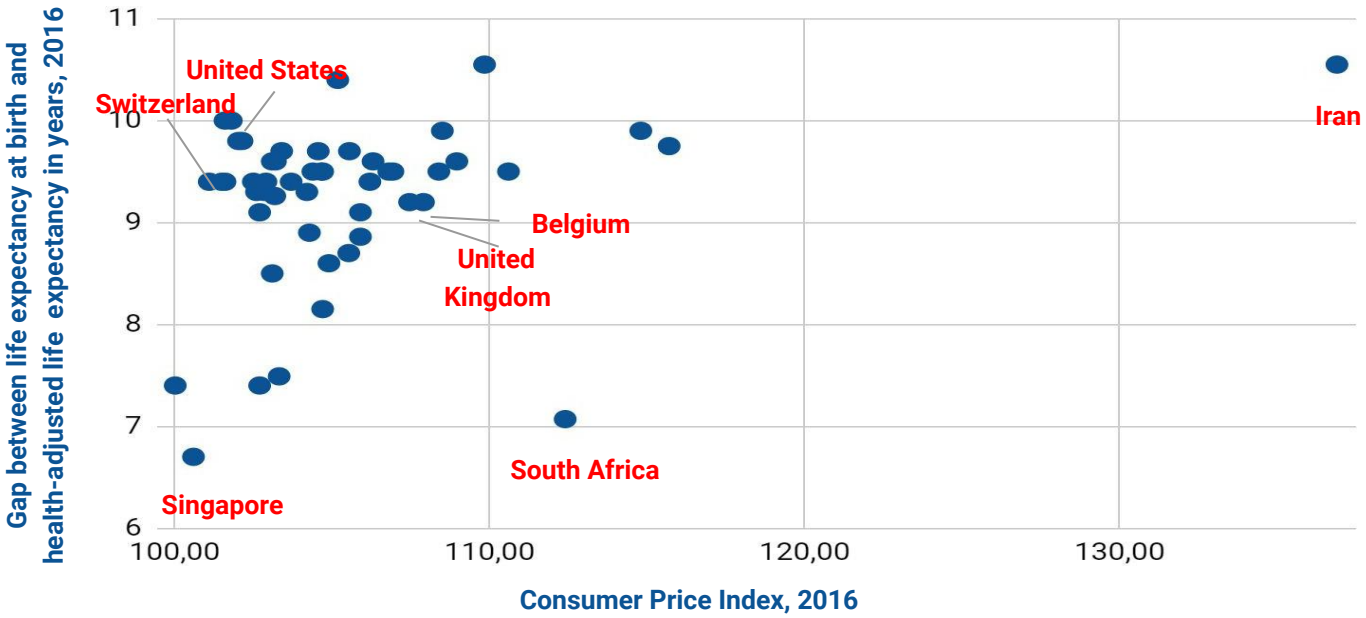
Countries like Germany, Finland, France, Norway, New Zealand, Netherlands, and the United Kingdom have zero risk of catastrophic expenditure for surgical care. A well-developed infrastructure, ramified network of healthcare facilities and qualified medical staff are the necessary prerequisites for providing affordable care to citizens. In addition, universal health coverage policies address the financial problems faced by individuals seeking surgery.

Public Healthcare and Out-of-Pocket Expenditure



Unregulated direct charges often pose a significant hurdle to individuals that require health care. They also tend to contribute to high out-of-pocket payments and cause problems with financial protection. Out-of-pocket expenses place a heavy burden on households' financial resources and make healthcare unaffordable to low-income groups. As a result, there appear significant disparities in healthcare status between groups with different income levels. In contrast, public spending on health care is central to universal health coverage and social protection. However, no clear trend signifying that is observable at the moment. In the US, healthcare expenditure is a result of high administrative costs and corruption in healthcare.

Economic Instability and a Gap Between HALE and Life Expectancy

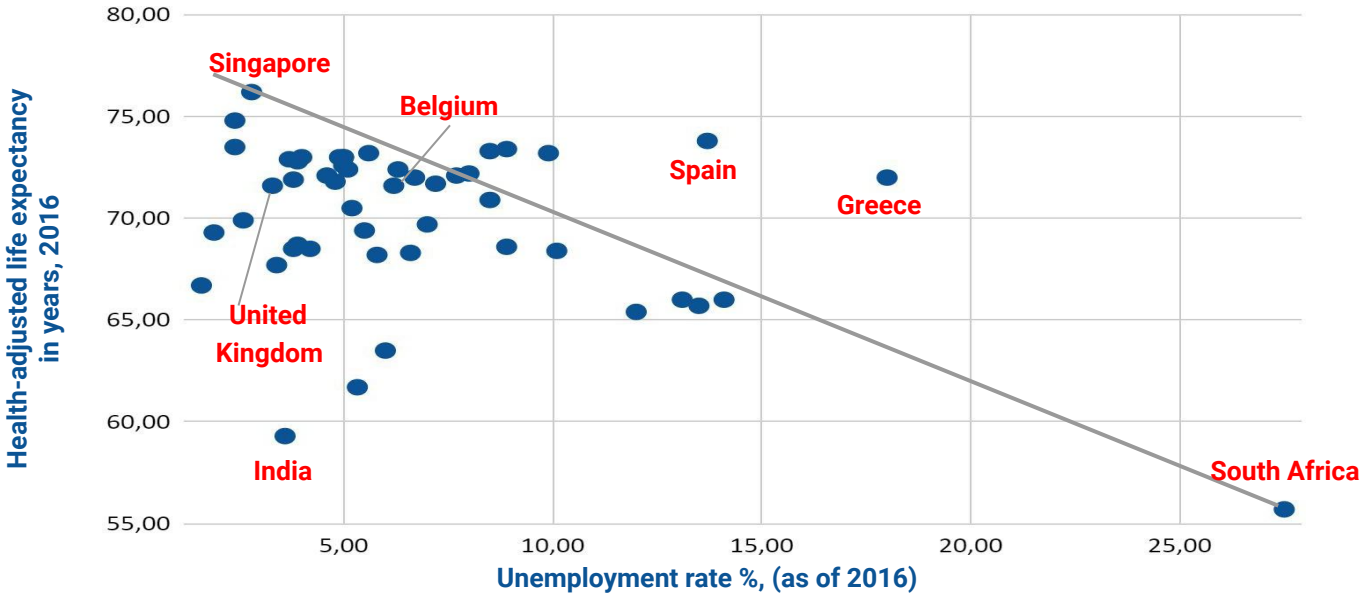


The Consumer Price Index (CPI) is used to measure the average change in prices paid by consumers for goods and services over time. CPI characterises prices' instability and economic instability whereas inflation indicates recession or systemic crises.

According to the 2019 **Medical Trends Around the World survey**, health conditions, supplier factors and consumer habits are the primary factors contributing to increased costs. A surge in prices for basic medical services and goods make healthcare less affordable and leads to higher inequality in a healthcare status.

The graph shows that an **increase of CPI** contributes to an increase in a gap between **life expectancy at birth and HALE**. The lowest level of CPI in 2016 was observed in **Singapore**, while the highest one was in Iran.

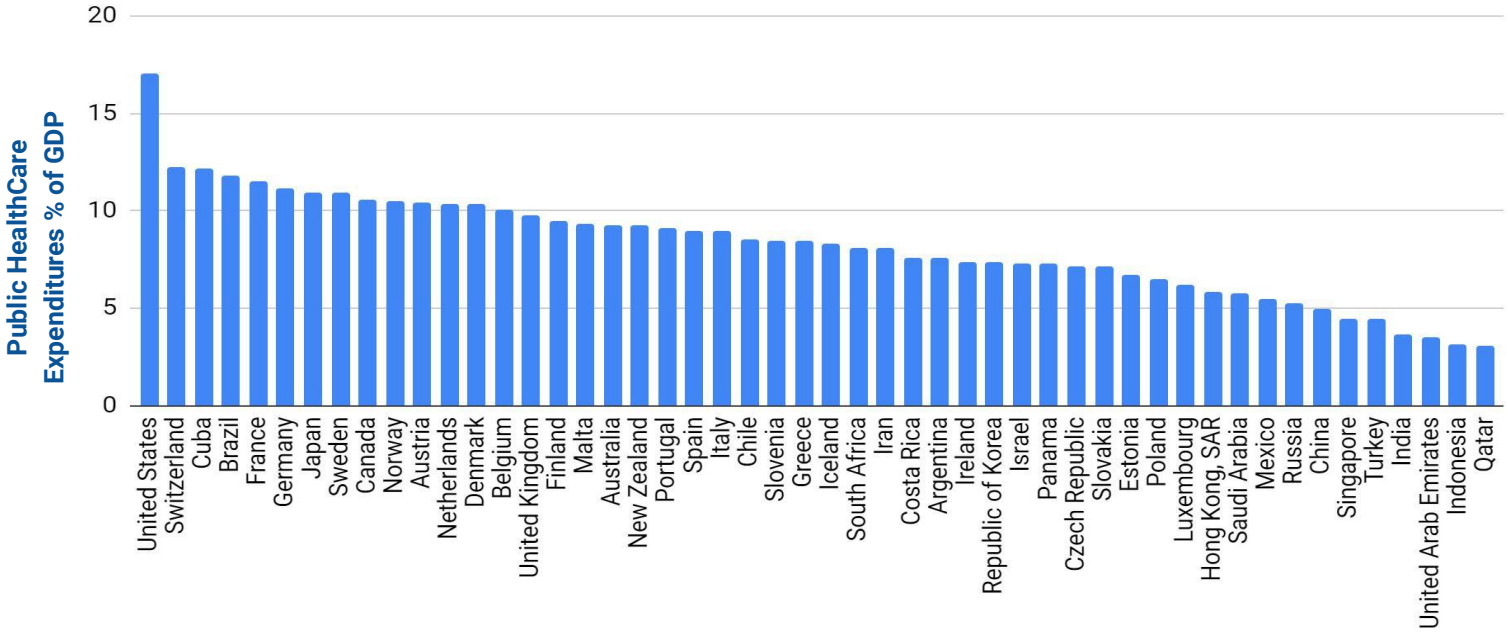
Unemployment and Healthy Longevity



A high unemployment rate leads to the reduction in health-adjusted life expectancy. Countries with a low unemployment rate (i.e. those of them that are close to natural level of unemployment) have higher HALE. A high unemployment rate also leads to social inequality and inability of people to afford basic goods and services.

However, the graph also show that an increase in unemployment rate leads to a decrease in a gap. Such inverse relations can be explained by the fact that life expectancy and HALE are modeled indicators, with the latter being more inertial in nature and having lower elasticity than the former.

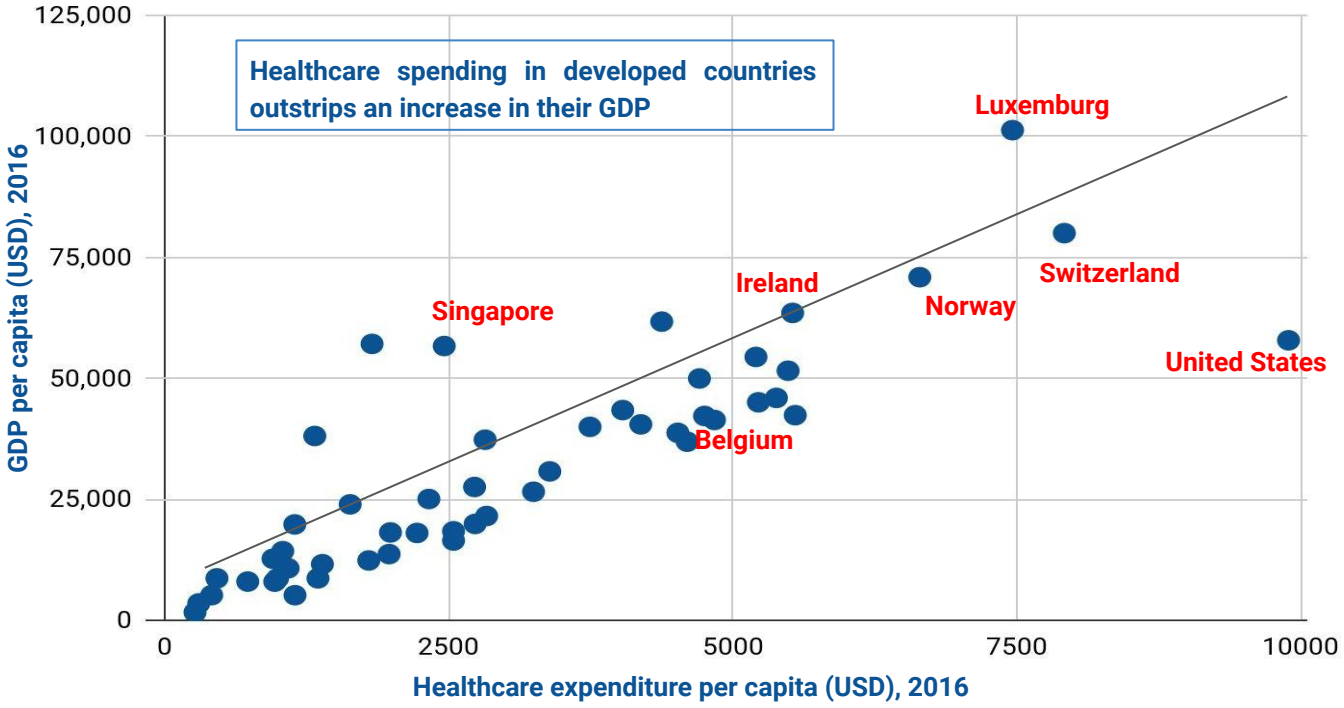
Public Healthcare Expenditure



It is absolutely vital for countries to invest in their healthcare sector. Evidence shows that investing in the healthcare sector results in substantial benefits for a country's economy. In developing countries, increased healthcare expenditure will lead to the improvement of the health status of the population of an entire region.

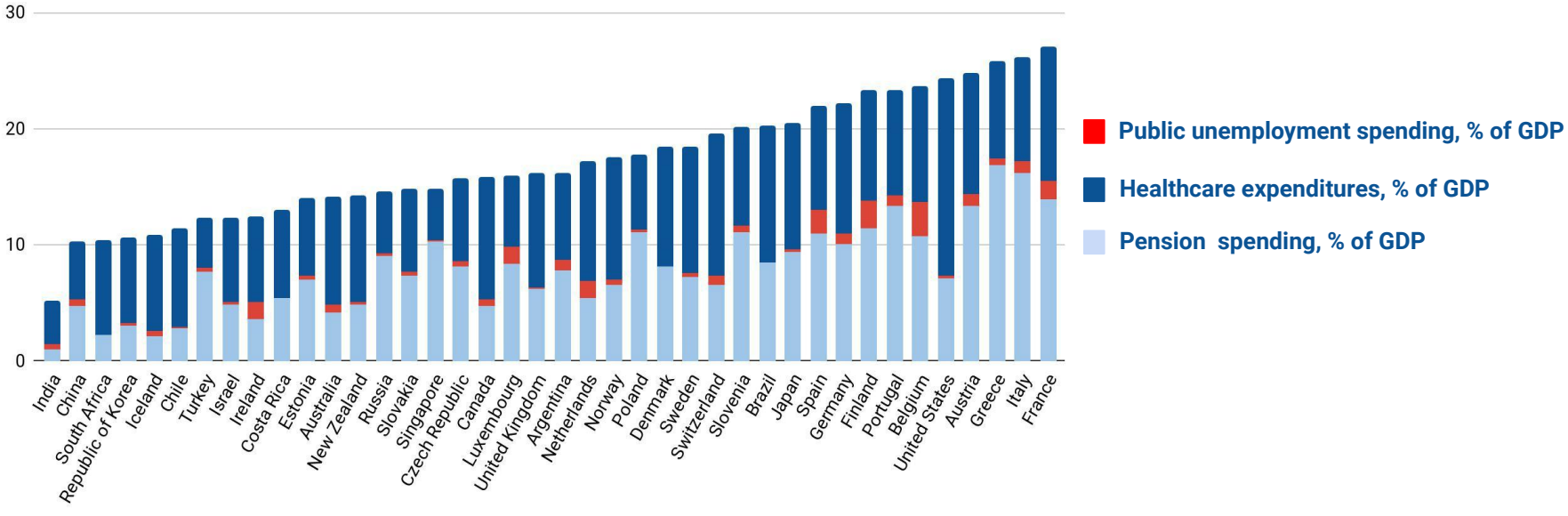
The only exception to this rule is the United States, which spends a disproportionate amount of money on health care. This, in turn, leads to increased financial burden and has very little effect on general public health.

Healthcare Spending and GDP



This chart represents a correlation between healthcare spending and GDP per capita. Data provided by the World Bank and Organization of Economic Cooperation and Development (OECD) in 2016 suggests that wealthy countries, such as the United States, Norway, Switzerland, Luxemburg, and Sweden, tend to increase Healthcare budgeting, in comparison with middle-income countries, such as India, Brazil, South Africa, and Indonesia. Comparing health spending in different countries can be a challenge due to the political, economic, and social systems.

Social Protection and Healthcare



Different countries have different political, economic, and social systems. Hence, they tend to allocate various sums of money to social protection programs. In 2016, the US spent some 17.1 percent of its GDP on healthcare – more than twice the average among developed countries.

Greece has the most significant pension expenditure (16.9%), but this does not allow you to pay high pensions. It is caused by the solidarity pension system, which continues to operate in Greece and won't be changed in the nearest future. Therefore, due to a disproportionately high number of pensioners and the low number of workers, the current state is not changing and worsens.

Healthcare Spending Per Capita by Country

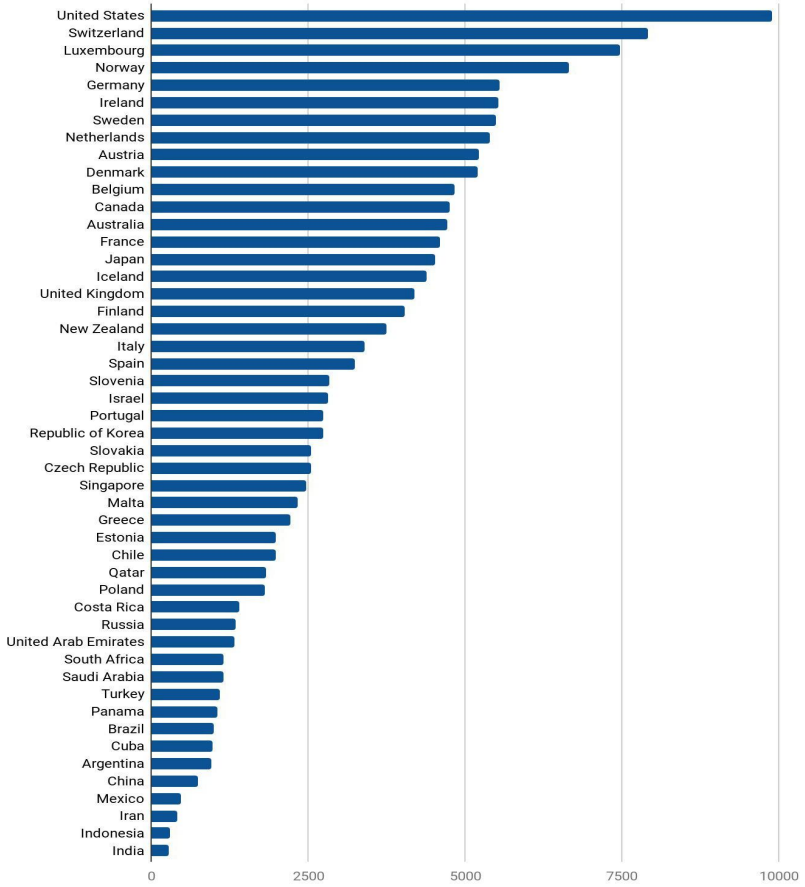
How much a country spends on its healthcare system and how its health expenditure changes over time is impacted by a number of social and economic factors, as well as the structure of a country's healthcare system.

The United States spends more on healthcare than any other country in the world, with its federal government being one of the biggest spenders. Relative to the size of its wealth, the US spends a disproportionate amount of money on healthcare - 80% more than Germany and twice as much as Japan, Canada and France. In the medium term, the US Center for Medicare and Medicaid Services (CMS) expects healthcare spending to exceed the country's GDP. It explains the increase by rapidly growing prices for medical supplies.

After a slowdown in 2009-2011 caused by the global financial crisis, health expenditure per capita in different countries continued to grow in 2016.

In Singapore, health expenditure is projected to grow faster than GDP, which may potentially result in the growth of private healthcare. The growth may also lead to increased spending on research and development of pharmaceutical products, medical devices and laboratory services.

Healthcare expenditure per capita (USD), 2016

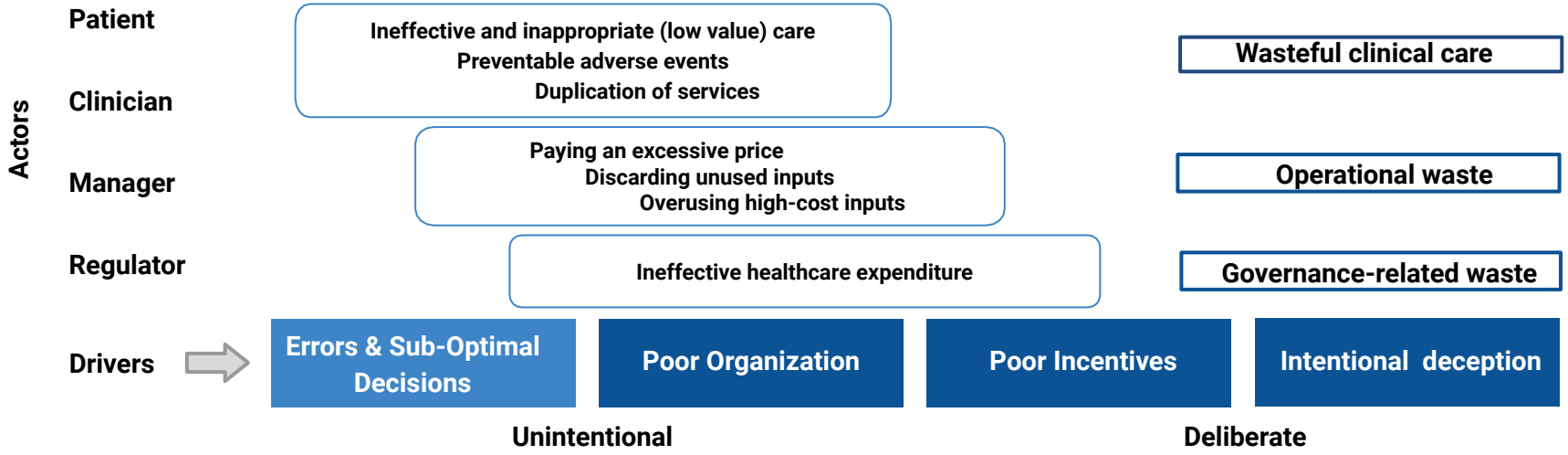


Disproportionately High Health Expenditure

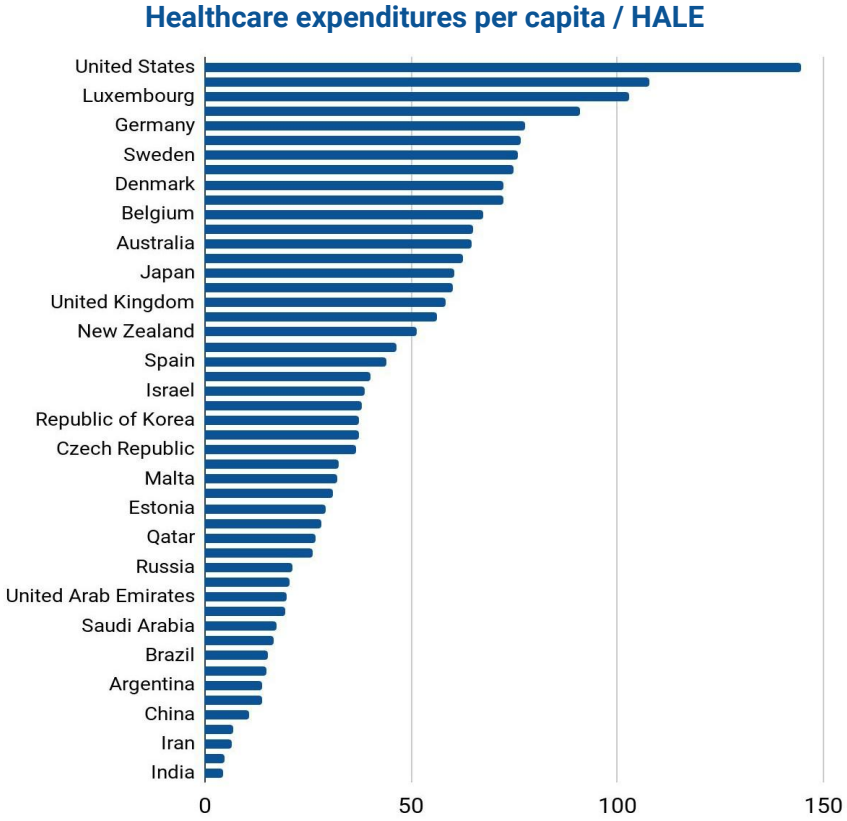
Health expenditure is rising in the United States and in the majority of OECD countries. However, an increase in health expenditure is having little or no effect on the improvement of people's health. In some cases, it even results in worse health outcomes. The US could potentially spend significantly less on healthcare without a detriment to its healthcare system or adverse health outcomes.

Behavioral root causes of disproportionate health expenditure include:

- imperfect knowledge and cognitive biases;
- poor management, organization and coordination;
- incentives misaligned with system goals.



Healthcare Spending and HALE



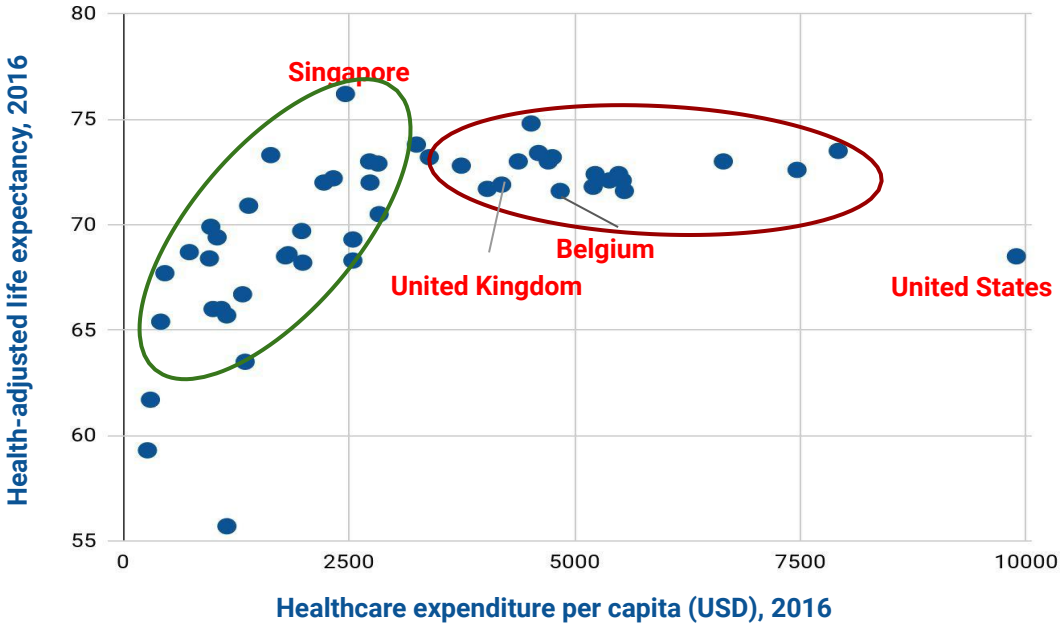
Healthcare spending per capita divided by HALE equals an efficiency ratio, i.e. a country's average health expenditure in one healthy life year.

Despite spending a disproportionately high amount of money on healthcare (more than any other country in the world), the US has a relatively low HALE. In fact, its HALE is the lowest among high-income developed countries, including Western European countries, Australia, and Japan. This is explained by the fact that chronic diseases pose the biggest threat to longevity in the country nowadays.

Having one of the most comprehensive healthcare systems in the world, Luxembourg can provide its citizens with virtually unrestricted access to healthcare. Luxembourg also ranks fifth for per-capita health expenditure. The country spends almost 8% of its Gross Domestic Product (GDP) on healthcare, which translates into a high HALE and life expectancy.

Spending the least on healthcare, India has the lowest HALE value. Lack of healthcare facilities in the country further contributes to bad health of its citizens and a low HALE value.

Healthcare Spending and Health-Adjusted Life Expectancy



Based on 2016 data from the OECD and World Health Organization, this chart represents a correlation between health expenditure and Health-Adjusted Life Expectancy (HALE).

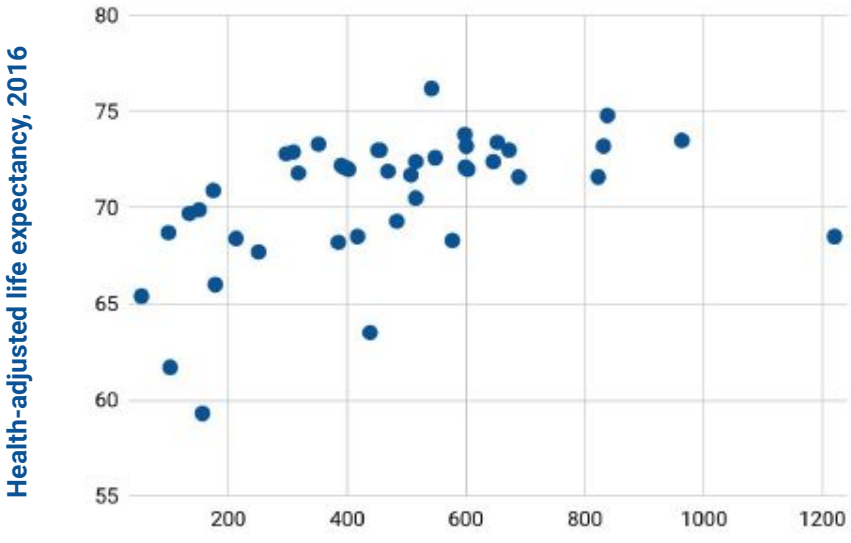
As we can see, there is no linear relationship between life expectancy and health expenditure. What it means is that increased public expenditure on healthcare does not guarantee a healthier and longer life.

The graph is divided into two main groups. The first one represents developing countries, such as India, Brazil, Russian Federation, Argentina, where increased public spending contributes to an increase in healthy life.

The second group represents developed countries whose per capita health expenditure, including healthcare-related expenses, is much higher than that of lower-income countries; however, that does not lead to an increase in the life expectancy of their citizens.

If we compare the United States and Singapore, we can see the most striking difference in the effectiveness of public healthcare expenditure. As of 2016, their per capita GDP stood at $57, 904,2 and $56, 724,2 respectively, which means that they have roughly the same level of wealth. However, lower per capita health expenditure in Singapore contributes to higher Health Adjusted Life Expectancy (HALE), as compared to the United States.

Pharmaceuticals Spending per capita and HALE



Pharmaceuticals spending per capita (USD), 2016

This chart collection takes a look at how pharmaceuticals spending are correlated with Health – Adjusted Life Expectancy. The analysis looks at 2016 health data from OECD and World Health Organization.

There is no strong relationship between HALE and pharmaceuticals spendings as only 23% of variation in HALE is explained by variation in pharmaceuticals expenditures per capita.

Pharmaceuticals spending is an adjusted indicator as it covers expenditure on prescription medicines and self-medication, often referred to as over-the-counter products.

It is aggregated and its components vary across countries. In some countries, different medical non-durable goods are included. Total pharmaceutical spending refers in most countries to “net” spending, i.e. adjusted for possible rebates payable by manufacturers, wholesalers or pharmacies.

The high value of pharmaceuticals spendings in the United States is caused by high medical prices. Switzerland is the second by this indicator. The growth of pharmaceuticals spendings in Switzerland is due to the launch of new and innovative medicines – especially for cancer. In Singapore the government pursues cost-effective approach for drugs development and other medical treatment, that is why relatively small amount of spendings corresponds to the highest HALE across observed countries.

Social Protection and Healthcare vs HALE

To estimate the relationship between social protection and healthcare spending vs HALE, we have used the Intraclass Correlation Coefficient (ICC). Ranging from o to 100%, it measures the reliability of ratings or measurements for clusters (this data has been arranged in groups).

A high ICC (close to 100%) indicates that the variance of a dependent variable (i.e. HALE) can be explained by the variance of a chosen factor (type of spending).

- A low ICC (close to zero) means that the relation between two values is low and can, therefore, be deemed insignificant.

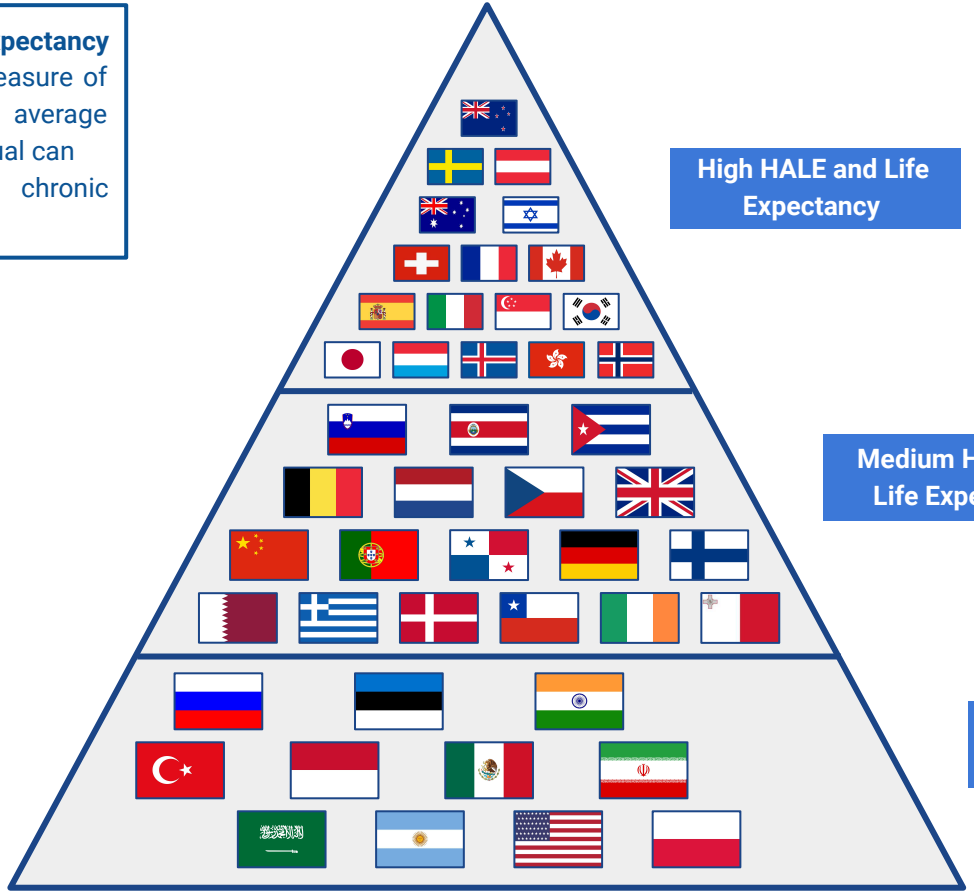
Type of spending, USD	Number of estimated groups	ICC, %*
Health spending per capita	7	58.1
Pharmaceuticals spending per capita	5	37.2
Public unemployment spending per capita	5	42.6
Pension spending per capita	6	57.2
Social expenditure per capita	6	38.6

** These are approximate assessments, as the nature of an indicator may vary across 50 countries analyzed. Since data related to several countries were not available, they were excluded from the analyses.*

The highest ICC is between per capita health expenditure and HALE. What this means is that a 58.1% variance in HALE can be explained by variance in healthcare spending. According to our analysis, this type of spending is the most significant factor influencing HALE. When it comes to pension spending, which is is the second sufficient indicator, the ICC is 7.2%. This is because pension spending provides an income for retired individuals or guarantees an income after an individual reaches a 'standard' pensionable age or fulfills the necessary contributory requirements.

Global Healthy Longevity Landscape Overview

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.



50 Countries:

High HALE and Life Expectancy - **17**

Medium HALE and Life Expectancy - **18**

Low HALE and Life Expectancy - **15**

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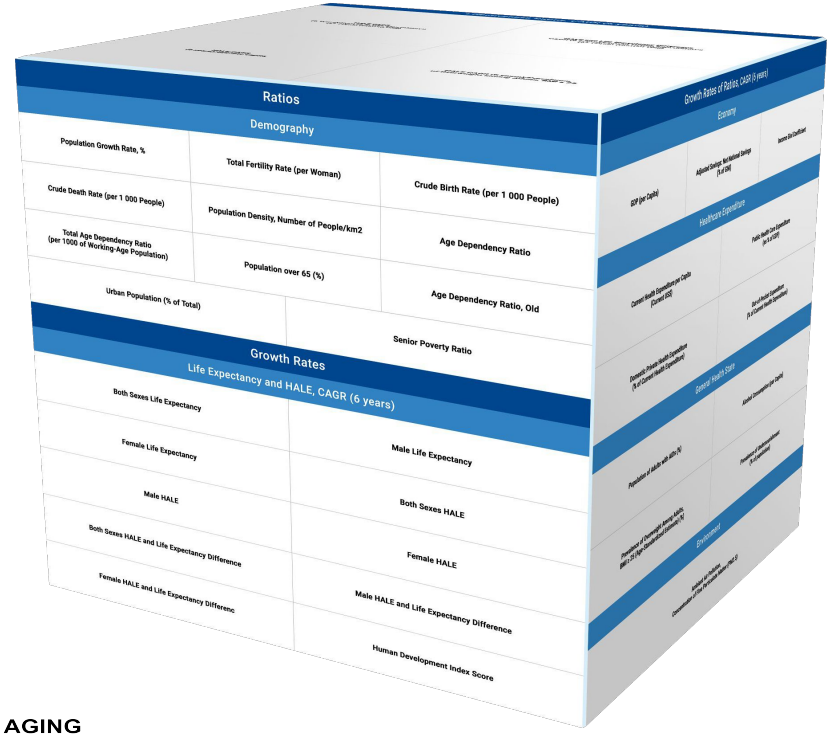
Big Data Analysis: Growth Rates, Growth Rates of Ratios, Effectiveness Ratios



Absolute values are enhanced by relative ones, and using both of them enables one to have a better understanding of the interaction between the two. It also provides one with an opportunity to investigate factors that have the biggest impact on HALE and life expectancy in a particular country.

Multicollinearity between some metrics is caused by the use of dummy variables and inclusion of a variable which is computed from other variables in a data set.

Each level of metrics is based upon extension, further subdivision or comparative combination of metrics in a preceding level, or is derived from insights provided by them.

Our analysis is based on open source data and information provided by the WHO, OECD, World Bank, and various institutions operating in a particular country.

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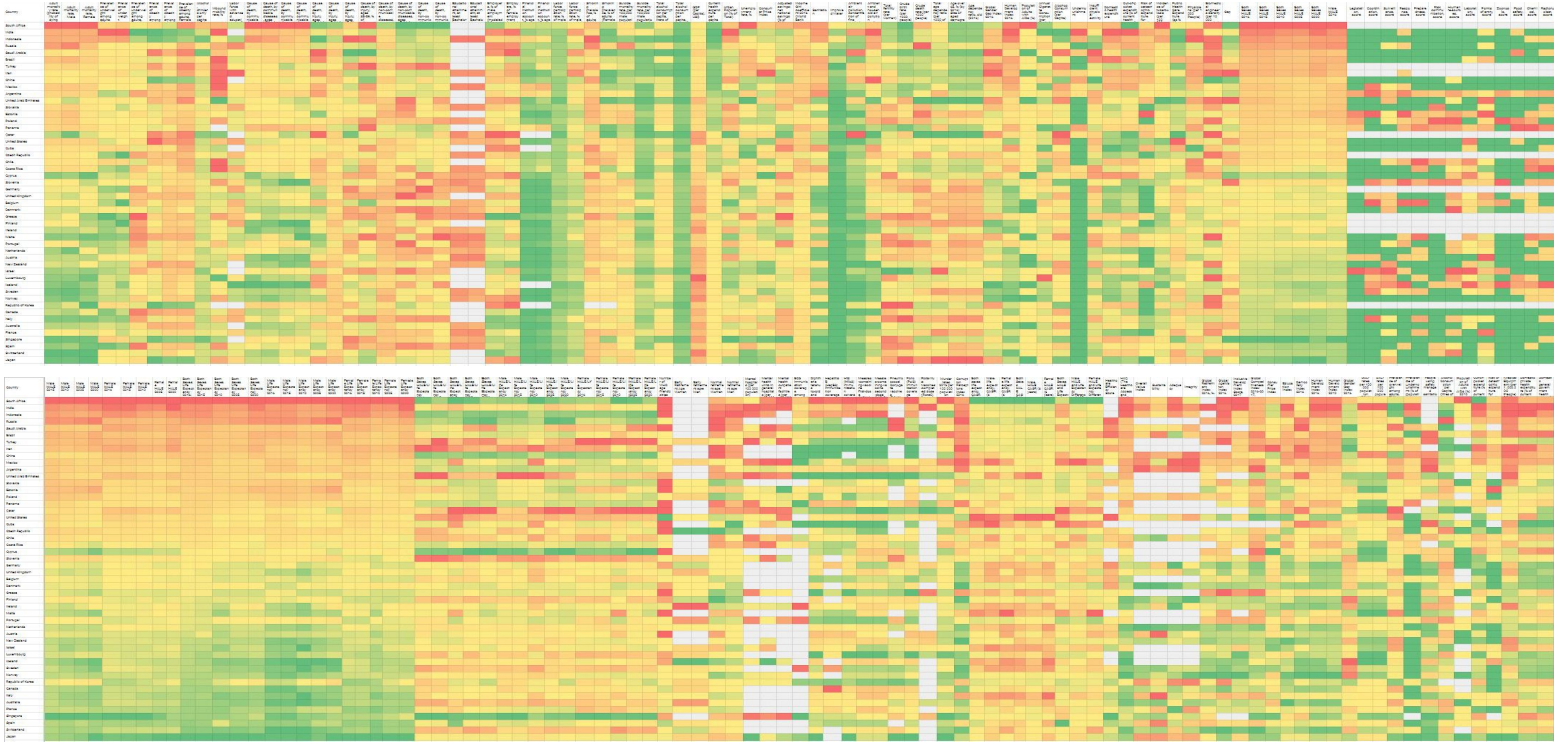
50 Countries and 200 Parameters

Based on the comparison of 200 parameters across 50 countries, patterns are recognized according to their distribution and variation. In so doing we aim to identify an interconnection between various metrics and classify countries into groups.



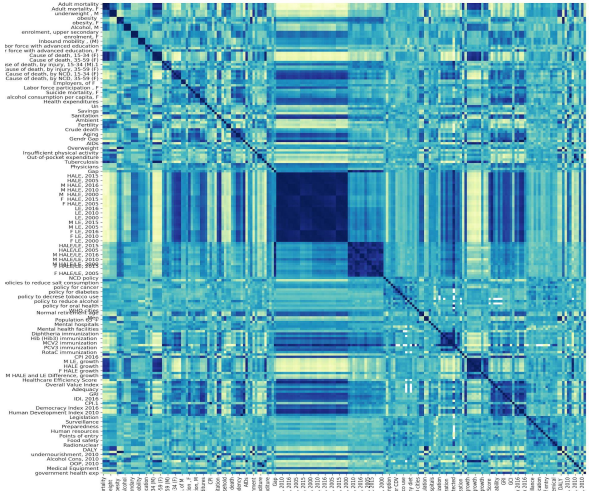
Big Data Comparative Analysis Framework

Big Data comparative analysis is based on the specific nature of parameters and their relationship. They help determine the development of healthy longevity progress across countries with different levels of economic development.

50 Countries

6 Layers and 200 Parameters

Correlations Between Parameters



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Longevity Governance: Big Data Analytics Dashboard

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Longevity Governance
Big Data Analytics Dashboard

Market Intelligence

Longevity Governance Market Intelligence

- Full Analysis
- Interactive Mindmaps
- SWOT Analysis
- Dynamic Charts

Full Big Data Analysis

View More

Dashboard Parameters

DATA POINTS	PARAMETERS	REGIONS
12000	240	50
LAYERS OF FRAMEWORK	**DYNAMIC CHARTS**	**SWOT ANALYSIS PROFILES**
6	100	50

SWOT Analysis

View More

Longevity Governance Market Intelligence

- Pre-Subscribe for Beta
- COVID-19 Dashboard
- 3D Visualization

Search Engine

Longevity Governance Search Engine

- Benchmarking Charts
- Major Trends
- Practical Recommendations
- Big Data Framework

National Healthy Longevity Interactive MindMaps

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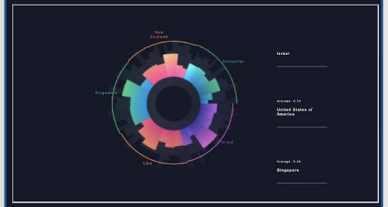
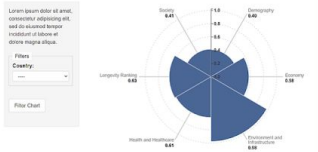
Longevity Progressivness 3D Visualization



Longevity Progressiveness Benchmarking Charts



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Longevity Governance Search Engine

- Health-Adjusted Life Expectancy (HALE) Gap and Life Expectancy
- Health-Adjusted Life Expectancy (HALE) Benchmarking

Longevity-Focused Financial Institutions

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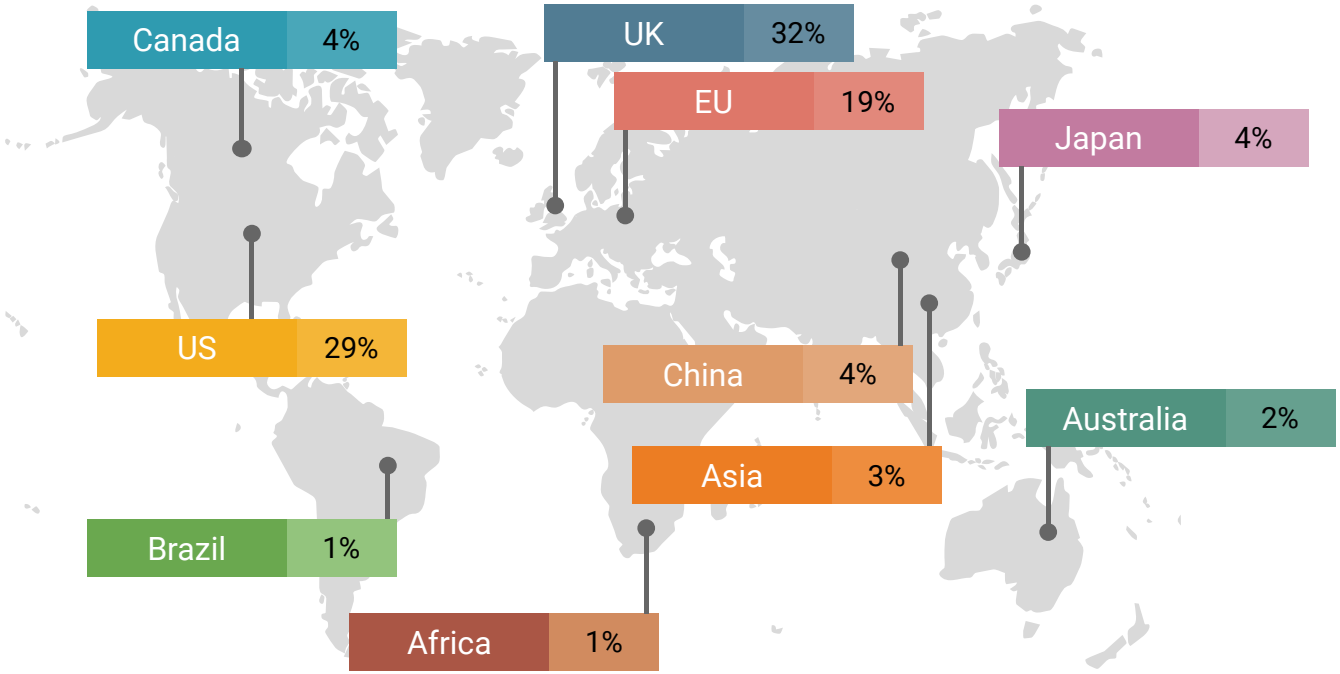
300 Financial Institutions: Regional Proportion



The chart represents distribution of longevity-focused financial institutions by country. Because the main selection criteria was a company's operation in the United Kingdom, it is clear that the largest number of the selected companies have their headquarters there. On the other hand, quite a few of them are headquartered in the US, which is explained by the availability of developed financial markets there.

Top 300 Financial Institutions by Sectors

105 Asset Management Firms

4BIO Capital, AEGON, AMG Funds, Bernstein, American Express, Amundi Asset Management, AON, apg, ArTex Funding, aspen, Asset Management One, ANZ, Baillie Gifford, Baird, Barings, Barnett Waddingham, Berkshire Hathaway, BlackRock, BNY Mellon Asset Management, BMO, Blackstone, CaixaBank Asset Management, Capital Group, Capital One, Center View Partners, 招商银行, Close Brothers, Columbia Threadneedle Investments, Coventry Building Society, Cowen Group, cpr, Crawford, Dimensional, Discovery, DWS, Eaton Vance Investment Managers, Evercore, Equitable, Fidelity, Fannie Mae, Franklin Templeton Investments, Freddie Mac, Global X, Goldman Sachs, Hargreaves Lansdown, ICC, ING, Insight Investment, ii, Invesco, Janus Henderson Investors, Jefferies, juno·capital, KKR, Lazard Asset Management, Leeds Building Society, Legg Mason Global Asset Management, M&G Investments, Macquarie, Mesirow, MFS, MUFG Financial group, Mizuho, Morgan Stanley, Nationwide Financial, Nationwide Building Society, NatWest Markets, Neuberger Berman, New York Life, nikko am Nikko Asset Management, NN, Nomura, Northern Trust Asset Management, nuveen, octopus ventures, Odey Asset Management, Old Mutual, ONEX, paragon, PIMCO, Principal, PNC, Rothschild & Co Asset Management, Russell Investments, Schroders, SEI, Skipton Building Society, St. James's Place Wealth Management, standard chartered, State Street, State Street Global Advisors, T.Rowe Price, Motilal Oswal Asset Management, TD Ameritrade Holding Corp., BNP Paribas Mutual Fund, UBS Financial Services Group, Vanguard, Vida Capital, Vitality, Wellington Management, Wells Fargo Asset Management, Western Asset, Willis Towers Watson, Yorkshire Building Society

75 Banks

中国农业银行 Agricultural Bank of China, ANZ Bank, Banco do Brasil, bradesco, Santander, bank hapoalim, Bank of England, Bank of America, 中国银行 Bank of China, 交通银行 Bank of Communications, Scotiabank, BMO, Bank of Ireland, BNY Mellon Bank, Bank of Scotland, BBVA, Bradford & Bingley, 中国民生银行 China Minsheng Bank, 中国建设银行 China Construction Bank, Citizens Bank, BNP Paribas, Commerzbank, Credit Suisse, Commonwealth Bank, Coutts, Crédit Agricole, Crédit Mutuel Banque à qui parler, citi, Credit Suisse, Crown Agents Bank, Danske Bank, DZ Bank Die Initiativbank, Deutsche Bank, EFG, Ford Credit, Barclays, Fifth Third Bank, HSBC, ICBC, Handelsbanken, Intesa Sanpaolo, Julius Bär, Itaú, Investec, Lloyds Bank, Moelis & Company, Metro Bank, MUFG Bank, M&S, nab, Natixis Beyond Banking, Nordea, NatWest Bank, Solomon, PJT, Rabobank, Sberbank, RBC, Raiffeisen Bank, RBS The Royal Bank of Scotland, JPMorgan Chase & Co., 浦发银行 SPD Bank, SMBC, Societe Generale, SBI, The co-operative bank, TD Bank, Truist, TSB, UBS, Weatherbys, usbank, UniCredit Bank, Wells Fargo Bank, Westpac

55 Insurance Companies

Admiral Group plc, Aflac, AIA, AIG, Allianz, Allstate, Argo Group, Aviva, Arch, AXIS, AXA, Canada Life, 中国人寿 China Life, 太平洋保险 CPIC, BaCE, Chubb, Dai-Ichi Life, Direct Line Group, CNP Assurances, Ecclesiastical Insurance Office plc, Great-West Lifeco, Generali, GIC Re, Ergo, Guardian, Humana, icaria, かんぽ生命, Manulife, Mapfre, Legal & General, kotak life, MS&AD Insurance Group, PICC, New York Life, MetLife, Phoenix Life, QBE, 中国平安 Ping An, Prudential Financial, R+V, Royal London, RSA, Rothesay life, Scottish Widows, Securis Investment Partners, Sompo Holdings, Sirius Group, Standard Life, unum, Tokio Marine, Sun Life Financial, Travelers, The Hartford, Zurich

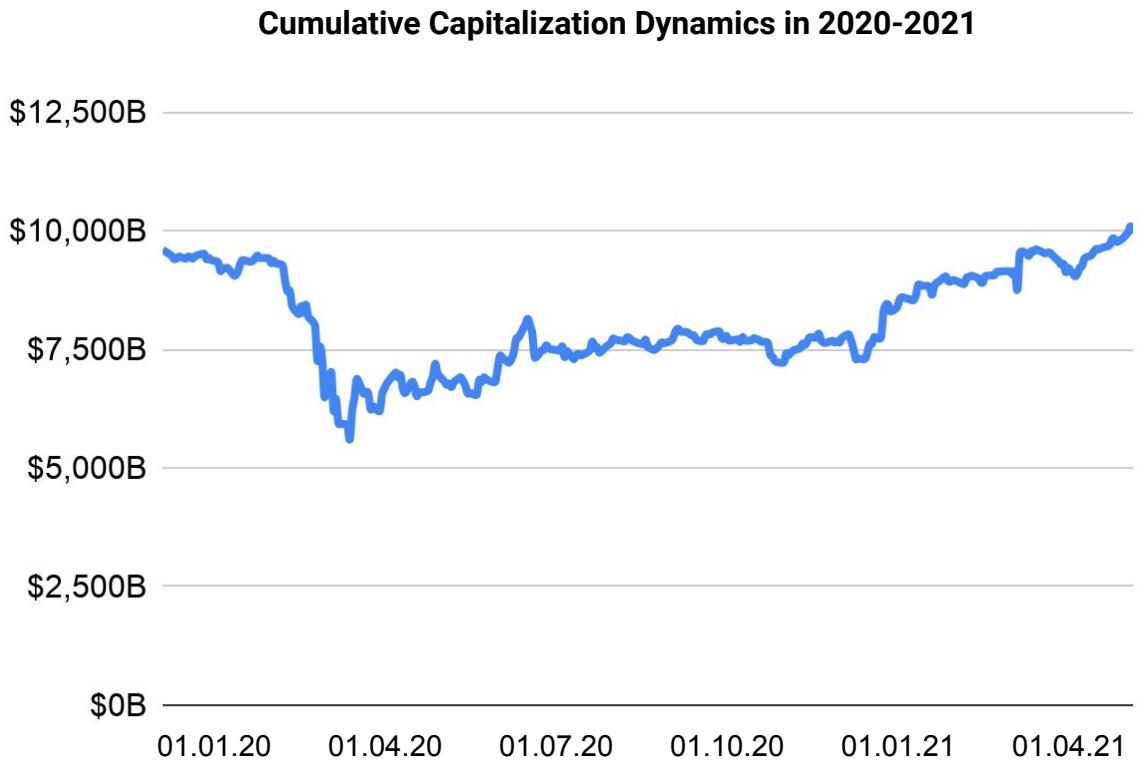
20 Reinsurance Companies

Everest, hannover re, China Re, RenaissanceRe, Mapfre, Korean Re, Hodge Lifetime, Market, PeakRe, Munich Re, PartnerRe, Pacific Life Re, RGA, SCOR, Swiss Re, Odyssey Re, ToaRe, talanx, TransRe, Scottish Re

45 Pension Funds

Abbott Pension Scheme, AkzoNobel, AstraZeneca, ABP, babcock, BAE Systems, bp, BBC Pension Scheme, British Airways Pensions, The British Steel Pension Scheme, Cobham, CHT Group, CVS Health Pension Scheme, sse Pension Scheme, Electricity Pensions Trustee, Essex Pension Fund, gmpf, HBOS plc, IBM, Heineken Pension Fund, Lafarge, Pension Fund, itv Tonight How Safe Is Your Pension?, LPFA your pension our world, MNOPF, MPS Mineworkers' Pension Scheme, RBS Pension Fund, Pilkington, nationalgrid, Railways Pension Scheme, Pension Fund, PensionBee, Pirelli Pension Fund, Berkshire Pension Fund, Scottishpower, TESCO pension, Total, West Yorkshire Pension Fund, Shell Pension Fund, West Midlands Pension Fund, Tyne and Wear Pension Fund Administered by South Tyneside Council, USS

Financial Institutions Advancing the Longevity Industry

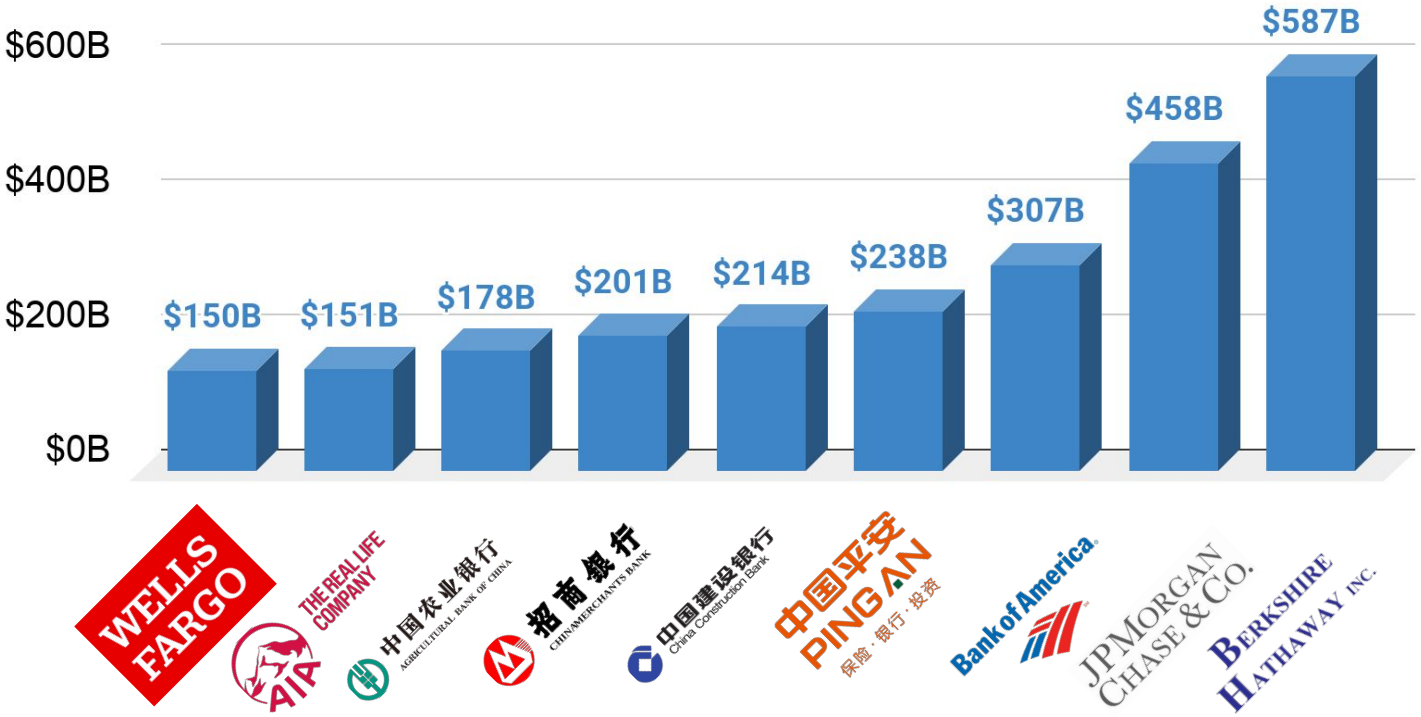


Since Q1 2020 market downturn, 194 financial institutions have fully recovered by year-end and continued to grow in 2021.

The largest institutions by market capitalization are Berkshire Hathaway, JPMorgan Chase & Co., Bank of America, and Ping An.

Given that many longevity advancing financial institutions are included in the S&P 500, this chart represents the approximate dynamics of the whole stock market.

Top 10 Financial Institutions in 2021 (by Market Capitalization)



www.aginganalytics.com/longevity-public-corporations

Top-20 Financial Institutions by Stock Exchange

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NYSE

US-Based

- Berkshire Hathaway (BRK-B)
  Market Cap: $587B
- JPMorgan Chase & Co.(JPM)
  Market Cap: $458B
- Bank of America Corp.(BAC)
  Market Cap: $307B
- American Express (AXP)
  Market Cap: $112B
- Citigroup (C)
  Market Cap: $144B
- Goldman Sachs Group Inc. (GS)
  Market Cap: $114B
- Wells Fargo & Co. (WFC)
  Market Cap: $150B
- Morgan Stanley (MS)
  Market Cap: $147B

UK-Based

- HSBC Holdings PLC (HSBC)
  Market Cap: $120B

China-Based

- China life (LFC)
  Market Cap: $120B

Canada-Based

- Royal Bank of Canada (RY)
  Market Cap: $122B
- Toronto-Dominion Bank (TD)
  Market Cap: $111B

Hong Kong (HKEX)

China-Based

- China Construction Bank (939)
  Market Cap: $214B
- China Merchants Bank (3968)
  Market Cap: $201B
- Bank of China (3988)
  Market Cap: $137B
- AIA Group(1299)
  Market Cap: $151B

NASDAQ

Switzerland-Based

- AstraZeneca pension fund(AZN)
  Market Cap: $127B

China (SSE)

China-Based

- Ping An Insurance (601318)
  Market Cap: $238B
- Agricultural Bank of China (601288)
  Market Cap: $178B

Australia (ASX)

Australia-Based

- Commonwealth Bank of Australia(CBA)
  Market Cap: $153B

Longevity-Focused Financial Institutions: Market Indices

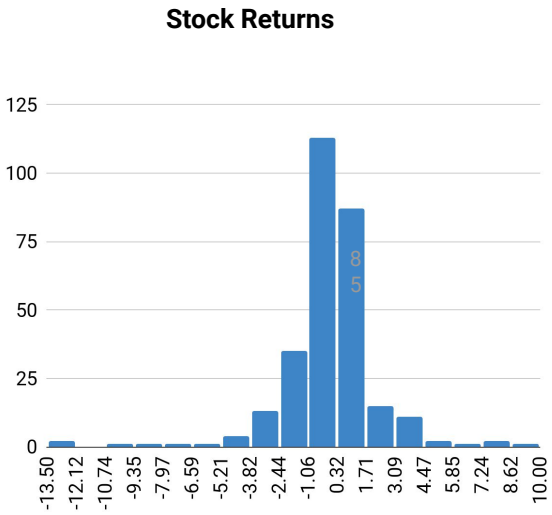
Our longevity stock index includes more than 300 longevity-focused corporations operating in the biotech and IT sectors.

Despite the volatility of the longevity stock market segment (by standard deviation), growth in the market capitalization of longevity-focused corporations far exceeds that of the entire market (as per the S&P500 index), as well as the general biotech industry indices (IBB and NBI).

Interestingly, distribution of the returns in the longevity stock market segment is right-skewed, which makes it different from the vast majority of stock indices and segments. What it means is that extraordinary positive events that rarely occur in the market play a major role in the capitalization of this segment, a phenomenon that can be described as the presence of “anti-black swans”. Many other indices are, on the contrary, characterized by negative skewness, which means that extraordinary negative events have greater probability of happening.

Distribution of longevity stock returns is definitely something that cannot be referred to as normal (curstosis exceeds 4.7).

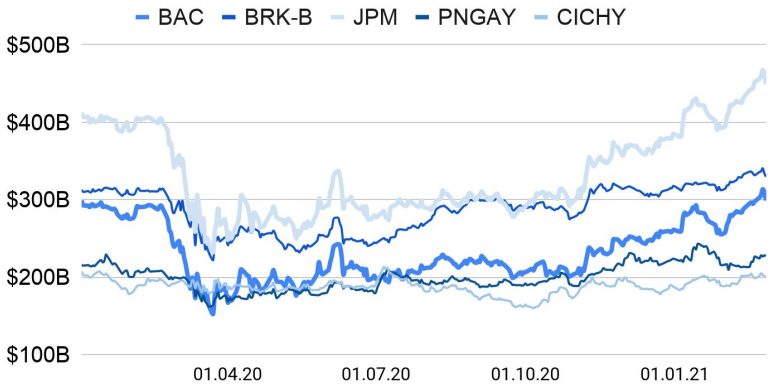
Index	Correlation with FInancial Institution index	Average daily return in 2020	Average daily volatility in 2020	Skewness	Curtosis
FInancial Institution index		-0.02	2.29	-1.06	8.96
S&P500	0.87	0.03	2.31	-0.97	8.56
Nasdaq Bank Index	0.83	-0.03	3.37	-0.38	2.89
SSE Composite Index	0.30	0.04	1.29	-0.71	9.91



Longevity-Focused Financial Institutions: Market Indices

Despite the crisis, all newly formed public companies have announced the successful closing of their IPOs. That is an indication of a volatile and yet steady growth, even though the net income of all corporations remains negative. Most IPOs took place in the USA in the second half of the year. The companies' beta is smaller than 1 (although it is positive), which means that the dynamics of longevity stock prices is in line with with the general market dynamics; however, the dynamics tends to be less pronounced (although volatility (by standard deviation) can be relatively high).

Capitalization change in 2020, $B



Name	Country	Market Cap	Annual Revenue	Net Income	Volume	Total Return Level	ROE	ROA	PE Ratio	Beta (1Y)
Berkshire Hathaway	USA	601.85B	286.26B	42.52B	5.850M	260.91	10.38%	5.22%	14.54	0.856
JPMorgan Chase & Co.	USA	477.13B	119.54B	29.13B	11.49M	582.16	12.24%	0.93%	17.72	1.228
Bank of America Corp.	USA	326.80B	86.27B	17.89B	45.56M	102.03	7.34%	0.67%	20.28	1.486
Ping An Insurance Group	China	236.27B	161.32B	20.75B	0.18M	31.06	20.22%	1.61%	11.09	0.7501
China Construction Bank	USA	199.03B	105.6B	35.31B	40.89K	N/A	12.08%	0.99%	6.03	1.25

Berkshire Hathaway

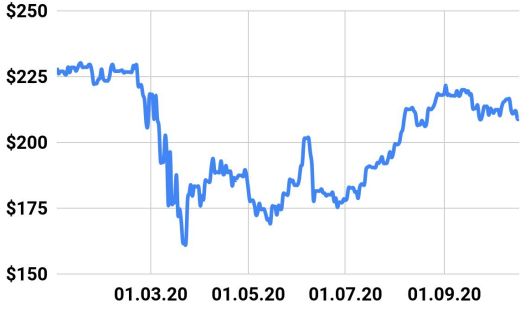
Berkshire Hathaway, Inc. engages in the provision of property and casualty insurance and reinsurance, utilities and energy, freight rail transportation, finance, manufacturing, and retailing services. It operates through the following segments: GEICO, Berkshire Hathaway Reinsurance Group, Berkshire Hathaway Primary Group, Burlington Northern Santa Fe, LLC (BNSF), Berkshire Hathaway Energy, McLane Company, Manufacturing, and Service and Retailing.

The company's revenue structure is as follows: **The Insurance** segment consists of private passenger automobile insurance, multiple lines of property and casualty insurance policies for primarily commercial accounts, excess-of-loss and quota-share and facultative reinsurance.

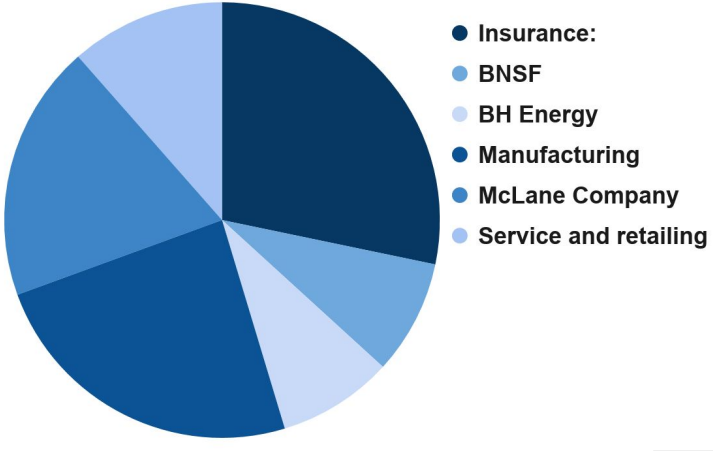
The BNSF segment operates railroad systems in North America.
The BH Energy segments deals with regulated electric and gas utility
The Manufacturing segment includes industrial products
The McLane Company segment offers wholesale distribution of groceries and non-food items.
The Service and Retailing segment provides fractional aircraft ownership programs, aviation pilot training, and various retailing businesses

Ticker	Volume (M)	Capitalization (B$)	Growth Rate(%)	Beta (1Y)
BRK.B	5.850	601.85	-7.65	0.856

Stock price



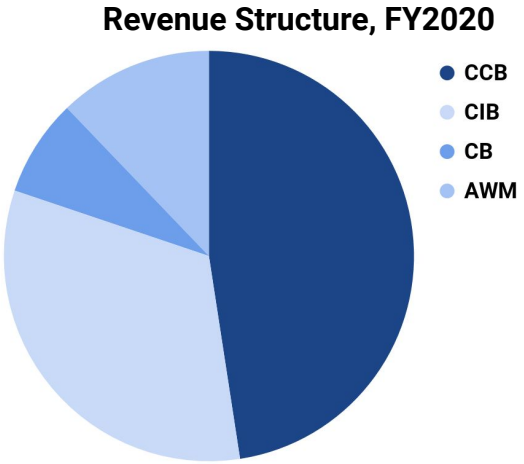
Revenue Structure, FY2020



JPMORGAN CHASE & CO

JPMorgan Chase & Co. is a global financial services provider operating in four segments: Consumer & Community Banking (**CCB**), Corporate & Investment Bank (**CIB**), Commercial Banking (**CB**), and Asset & Wealth Management (**AWM**). It offers a wide range of investment banking products and services in all capital markets, including advising on corporate strategy and structure, capital raising in equity and debt markets, risk management, market making in cash securities and derivative instruments, and brokerage and research.

The company's revenue structure looks as follows: **The CCB** segment offers lending, deposit, and cash management and payment solutions to small businesses. **The CIB** segment provides investment banking products and services **The CB** segment provides financial solutions to small business, large and medium-sized corporations, local governments, and non-profit clients. **The AWM** segment offers multi-asset investment management solutions to institutional clients and retail investors.

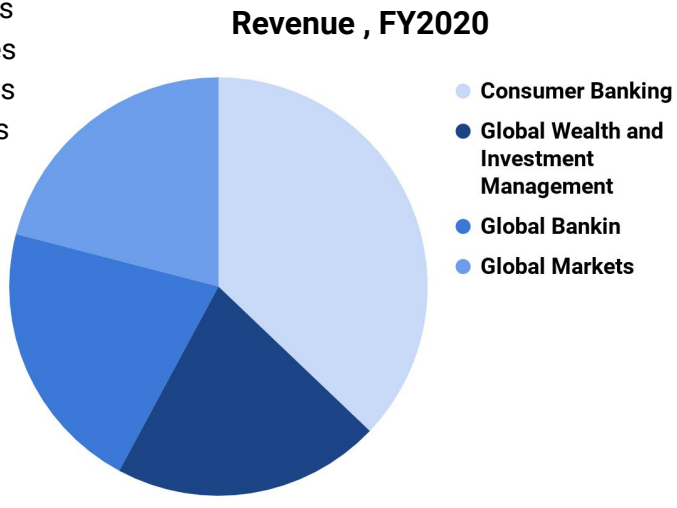


Ticker	Volume (M)	Capitalization (B$)	Growth Rate(%)	Beta (1Y)
JPM	11.49	477.13	-28.97	1.228

BANK OF AMERICA CORPORATION

Bank of America Corporation operates through the following segments: Consumer Banking, Global Wealth and Investment Management, Global Banking, Global Markets, and All Other. It provides banking and financial products and services for individual consumers, small and middle-market businesses, institutional investors, large corporations, and governments worldwide.

The company's revenue structure is as follows:
The Consumer Banking segment provides credit, banking, and investment products and services to consumers and small businesses.
The company's Global Wealth & Investment Management segment provides investment management, brokerage, banking, and trust and retirement products and services
The Global Banking segment provides lending products and services
The Global Markets segment provides market making, financing, securities clearing, settlement, and custody services

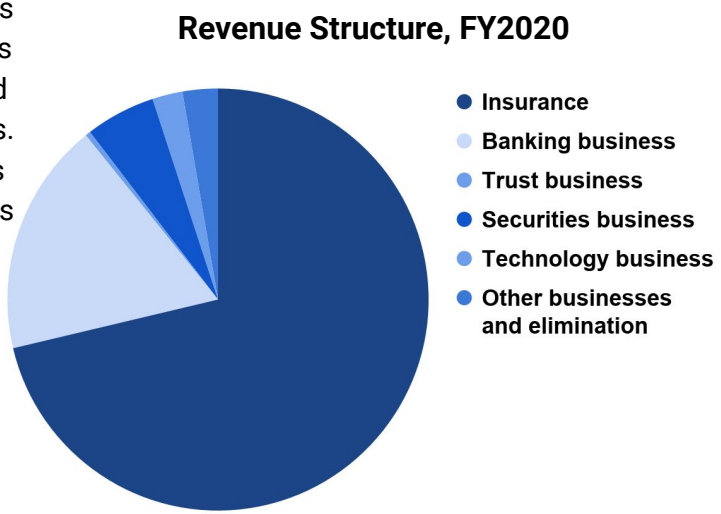


Ticker	Volume (M)	Capitalization (B$)	Growth Rate(%)	Beta (1Y)
BAC	45.56	326.8	-33.73	1.486

PING AN LTD INSURANCE (GROUP) COMPANY OF CHINA LTD

Ping An Insurance (Group) Company of China, Ltd. provides financial products and services for insurance, banking, asset management, and Fintech and Healthtech businesses in the People's Republic of China. It operates through the following segments: Insurance, Banking, Trust, Securities, Other Asset Management, Technology, and Others.

The company's revenue structure is as follows:
The Insurance segment provides life, property and casualty, pension, and health insurance services.
The Banking segment provides loan and intermediary business, wealth management, and credit card services
The Trust segment provides trust services and undertakes investing activities
The Securities segment provides brokerage, trading, investment banking and asset management services.
The Technology segment provides various financial and daily-life services through internet platforms

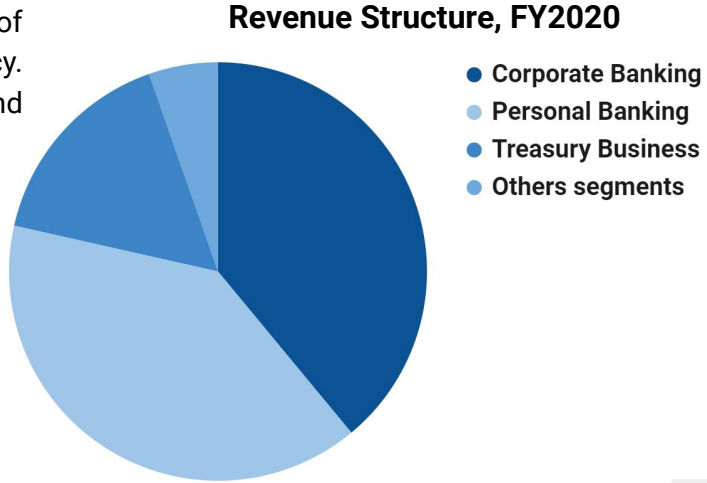


Ticker	Volume (M)	Capitalization (B$)	Growth Rate(%)	Beta (1Y)
PNGAY	0.18	236.27	-12.43	0.7501

China Construction Bank Corporation

China Construction Bank Corp. engages in the provision of a wide range of financial services to corporate and non-corporate customers. It operates through the following business segments: Corporate Banking, Personal Banking, Treasury, and Others.

The company's operating income is as follows:
The Corporate Banking segment provides a range of financial products and services to corporations, government agencies and financial institutions
The Personal Banking segment provides personal loans, deposit taking and wealth-management services, card business, remittance services, and agency services to individual customers.
The Treasury segment engages in inter-bank money market transactions, repurchase and resale transactions, investments in debt securities, and trade of derivatives and foreign currency.
The Other segment refers to equity investments and revenues, results, assets and liabilities of overseas branches and subsidiaries.



Ticker	Volume (M)	Capitalization (B$)	Growth Rate(%)	Beta (1Y)
CICHY	40.89	199.03	21.7	1.25

Longevity Finance: Big Data Analytics Dashboard

AGING ANALYTICS AGENCY

Longevity Finance
Big Data Analytics Dashboard

Market Intelligence

Longevity Finance Market Intelligence

- SWOT Analysis
- Interactive Mindmaps
- Market Intelligence

Interactive Mindmaps

View More

Dashboard Parameters

DATA POINTS	PERSONALITIES	CORPORATIONS
100019	2000	1000
STARTUPS	**INDUSTRIES**	**SECTORS**
5000	15	50

SWOT Analysis

View More

Longevity Finance Market Intelligence

- Pre-Subscribe for Beta
- Sponsorship Opporrtunities
- Request Custom Analytics

Search Engine

Longevity Finance Search Engine

- Interactive Database
- Dynamic Network Diagrams
- Competitor Search

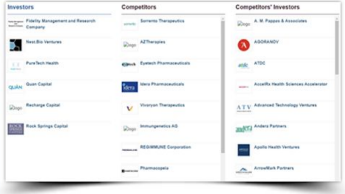
Interactive Database

FinTech | WealthTech | InsurTech

Interactive Network Diagrams

FinTech | WealthTech | InsurTech

Competitor & Investor Search



FinTech | WealthTech | InsurTech

Longevity Finance Search Engine

- Personalities
- Corporations
- Startups
- Investors

Publicly Traded Longevity-Focused Companies

AGING
ANALYTICS
AGENCY

Top-20 Publicly Traded Longevity-Focused Companies

AGING ANALYTICS AGENCY

NASDAQ

US-Based

- Turning Point Therapeutics (TPTX)
  Market Cap: $5 852M
- Fate Therapeutics (FATE)
  Market Cap: $9 727M
- Arena Pharmaceuticals (ARNA)
  Market Cap: $4 643M
- Gossamer Bio (GOSS)
  Market Cap: $852M
- One Medical (ONEM)
  Market Cap: $2 162M
- Tandem Diabetes Care (TNDM)
  Market Cap: $5 903M
- Vertex Pharmaceuticals (VRTX)
  Market Cap: $55 693M
- SAGE Therapeutics (SAGE)
  Market Cap: $4 888M
- Outset Medical (OM)
  Market Cap: $2 162M
- Kronos Bio (KRON)
  Market Cap: $1 566M

China-Based

- BeiGene (BGNE)
  Market Cap: $29 885M

UK-Based

- Abcam (ABCM)
  Market Cap: $5 400M
- Freeline Therapeutics (FRLN)
  Market Cap: $539M
- Orchard Therapeutics (ORTX)
  Market Cap: $954M
- Autolus (AUTL)
  Market Cap: $367M

Euronext Brussel (BR)

Switzerland-Based

- Biocartis (BCART)
  Market Cap: $315M

Copenhagen (CPH)

Sweden-Based

- Getinge (GETI-B)
  Market Cap: $7 320M

Hong Kong (HKD)

Hong Kong-Based

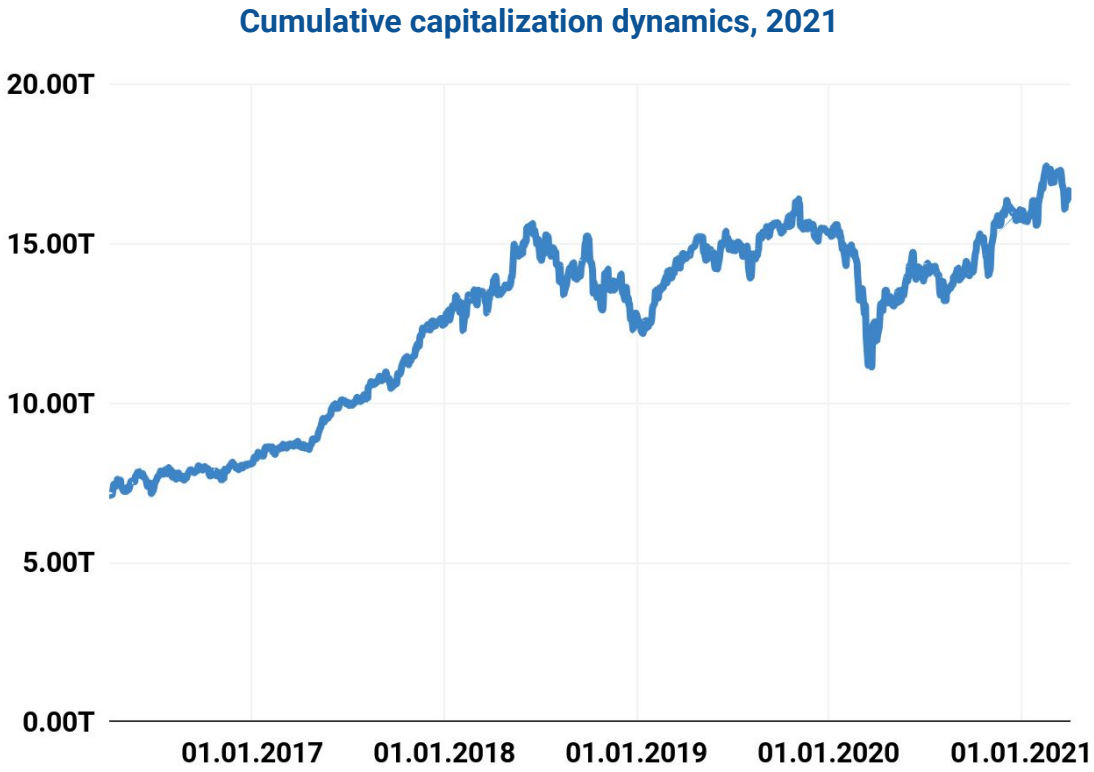
- Regent Pacific Group
  Market Cap: $72M
- Acquired
- Deep Longevity
  Acquired by $4M

NYSE

US-Based

- Amwell (AMWL)
  Market Cap: $6 884M
- TransEnterix (TRXC)
  Market Cap: $1 135M

Longevity Publicly Traded Companies



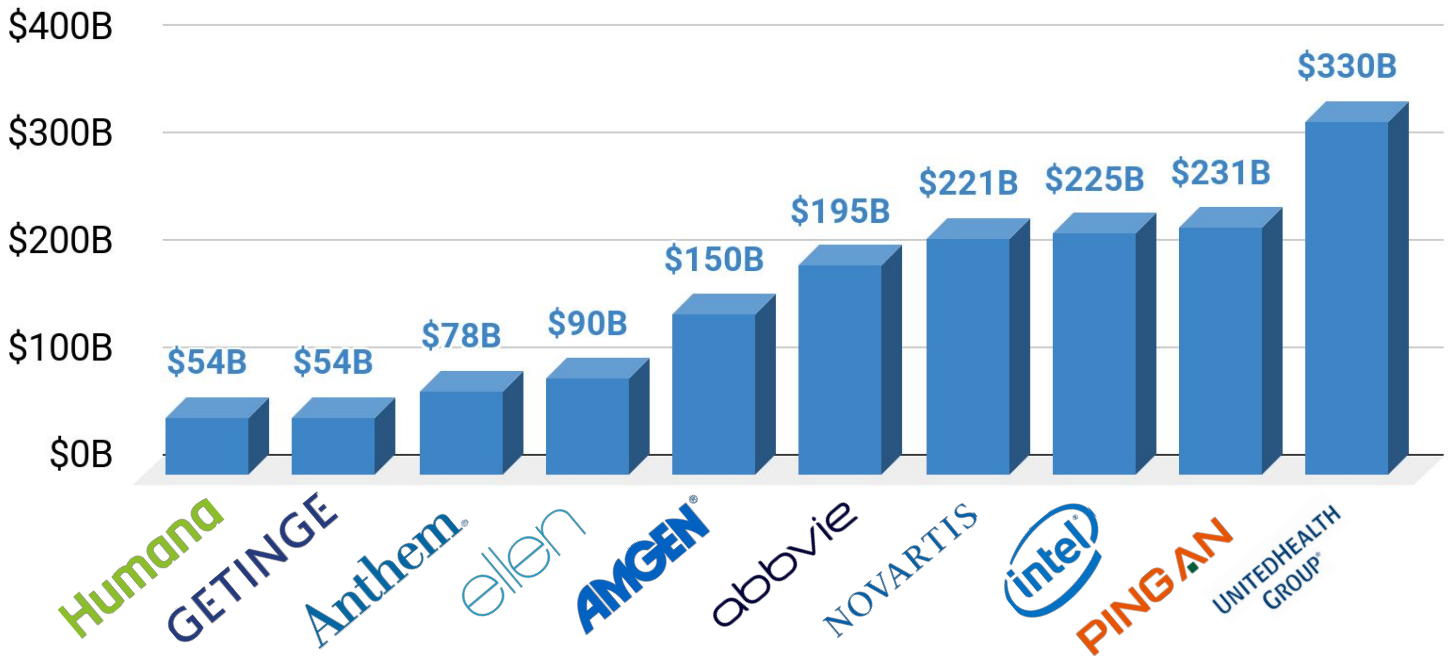
Due to the crisis, 321 publicly traded companies experienced a 27% decline in their stock prices in March 2020. Most of the companies recovered from that and presented **4.17% Growth** with **a cumulative capitalization of $16.03T.**

In 2020, **19 companies** announced the closing of their IPOs. The biggest companies are **Amwell, One Medical, Abcam, ALX Oncology, and Outset Medical** by resulting in capitalization.

The largest longevity companies are **UnitedHealth Group, Ping An, Intel, Novartis, and AbbVie.**

Technologically, publicly-traded longevity-focused companies are similar to other companies in the sector (i.e., those that reached B or C funding rounds), which means that their market capitalization growth can approximate the dynamics of the whole industry.

Top 10 Public Longevity-Focused Corporations by Market Capitalization (as of May, 2021)



www.aginganalytics.com/longevity-public-corporations

Longevity Market Capitalization

Our longevity stock index includes more than 300 longevity-focused corporations operating in the biotech and IT sectors.

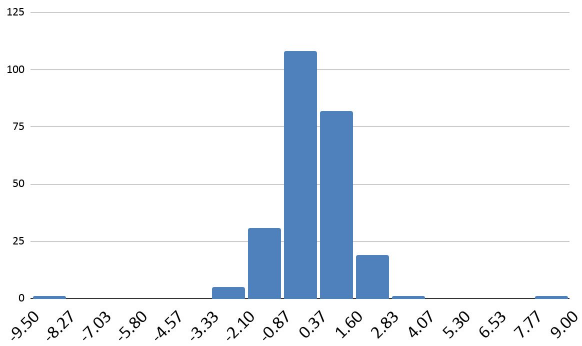
Despite the longevity stock market segment being more volatile (by standard deviation), growth in the market capitalization of longevity-focused corporations far exceeds that of the entire market (as per the S&P500 index), as well as the general biotech industry indices (IBB and NBI).

Interestingly, distribution of the returns in the longevity stock market segment is right-skewed, which makes it different from the vast majority of stock indices and segments. What it means is that extraordinary positive events that rarely occur in the market play a major role in the capitalization of this segment, a phenomenon that can be described as the presence of “anti-black swans”. Many other indices are, on the contrary, characterized by negative skewness, which means that extraordinary negative events have greater probability of happening.

Distribution of longevity stock returns is definitely something that cannot be referred to as normal (curstosis exceeds 4.7).

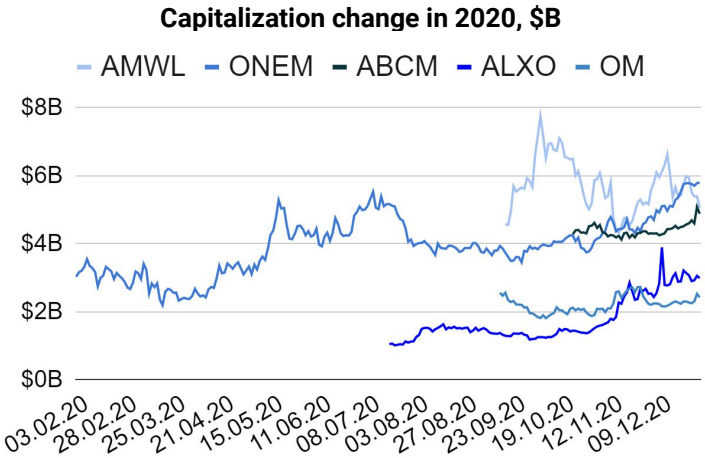
Index	Correlation with longevity market	Average daily return in 2020	Average daily volatility in 2020	Skewness	Curtosis
Longevity Index	-	0.12	1.29	-0.44	17.86
IBB	0.97	0.12	2.13	-0.15	3.11
S&P500	0.99	0.03	2.31	-0.97	8.56
NBI	-0.14	0.12	2.16	-0.19	3.40

Longevity stock returns histogram



Longevity IPOs in 2020

Despite the crisis, all newly formed public companies have announced the successful closing of their IPOs. That is an indication of a volatile and yet steady growth, even though the net income of all corporations remains negative. Most IPOs took place in the USA in the second half of the year. The companies' beta is smaller than 1 (although it is positive), which means that the dynamics of longevity stock prices is in line with with the general market dynamics; however, the dynamics tends to be less pronounced (although volatility (by standard deviation) can be relatively high).

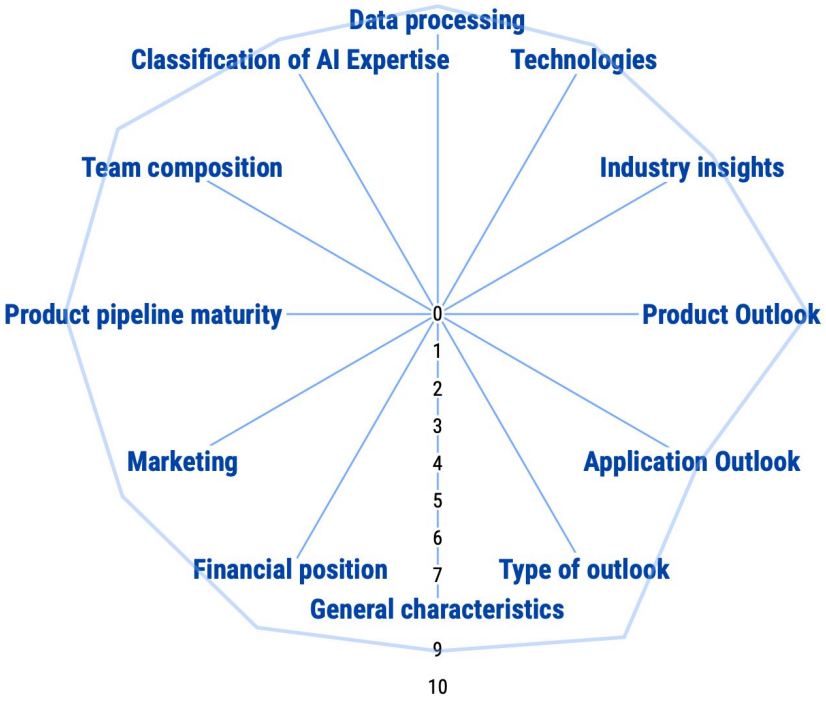


Name	Country	Funding Amount. M$	Investments in 2020 (M$)	IPO Date	Capitalization (M$)	ROA	ROE	Profit margin	Operating margin	EV/EBITDA	Net income
Amwell	USA	1553	1036.0	17.09.2020	7036	N/A	N/A	-85.51%	-87.39%	-30.12	-197
One Medical	USA	777.1	245.0	30.01.2020	6152	-7.51%	-26.19%	-29.78%	-26.06%	-93.34	-100
Abcam	UK	492.2	156.5	21.10.2020	5372	4.42%	2.82%	4.81%	0	121.85	13
ALX Oncology	USA	327.5	266.5	16.07.2020	3092	N/A	N/A	0	-1401.71%	-84.3	-35
Outset Medical	USA	689.0	366.7	14.09.2020	2094	N/A	N/A	-273.79%	-262.55%	-17.3	-109

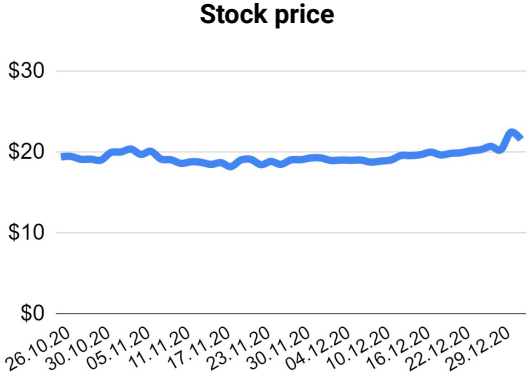
Longevity IPOs in 2020

Name	Country	Funding Amount. M$	Investments in 2020 (M$)	IPO Date	Capitalization (M$)	ROA	ROE	Profit margin	Operating margin	EV/EBITDA	Net income
Genetron Health	China	388.0	256.0	19.06.2020	1775	-12.92%	-2433.48%	0	0	-0.48	-469.59
Kronos Bio	USA	528.0	405.0	08.10.2020	1769	N/A	N/A	0	0	-30.98	-60.75
COMPASS Pathways	UK	243.7	207.5	18.09.2020	1631	N/A	N/A	0	0	-28.27	-49.16
Passage Bio	USA	441.5	216.0	27.02.2020	1271	-19.96%	-32.90%	0	0	-9.54	-86.44
Freeline Therapeutics	UK	434.8	238.8	07.08.2020	823	-12.71%	-27.37%	-243.39%	-212.81%	-37.41	-28.95
Inozyme	USA	262.1	112.0	23.07.2020	652	N/A	N/A	0	0	-9.40	-22.49
Akouos	USA	350.1	312.5	25.06.2020	628	N/A	N/A	0	0	-6.89	-45.67
Pandion Therapeutics	USA	273.0	215.0	16.07.2020	563	N/A	N/A	0.00%	-415.33%	-8.88	-26.04
BioVie	USA	28.1	15.6	17.09.2020	559	-16.98%	-187.97%	0	0	-95.10	-5.52
Fusion Pharmaceuticals	Canada	170.9	232.9	25.06.2020	504	N/A	N/A	0	0	-7.22	-73.15
Progenity	USA	238.5	100.0	19.06.2020	305	-111.71%	N/A	-208.01%	-239.45%	-1.67	-141.17
Numinus	Canada	20.8	20.8	20.05.2020	217	-110.97%	-460.92%	0.00%	-826.43%	-24.44	-9.60
Lyra Therapeutics	USA	123.5	94.0	05.05.2020	142	N/A	N/A	0	0	-3.06	-19.46
Perimeter Medical Imaging	Canada	19.8	7.9	29.06.2020	92	N/A	N/A	0	-7668.65%	N/A	N/A

Abcam

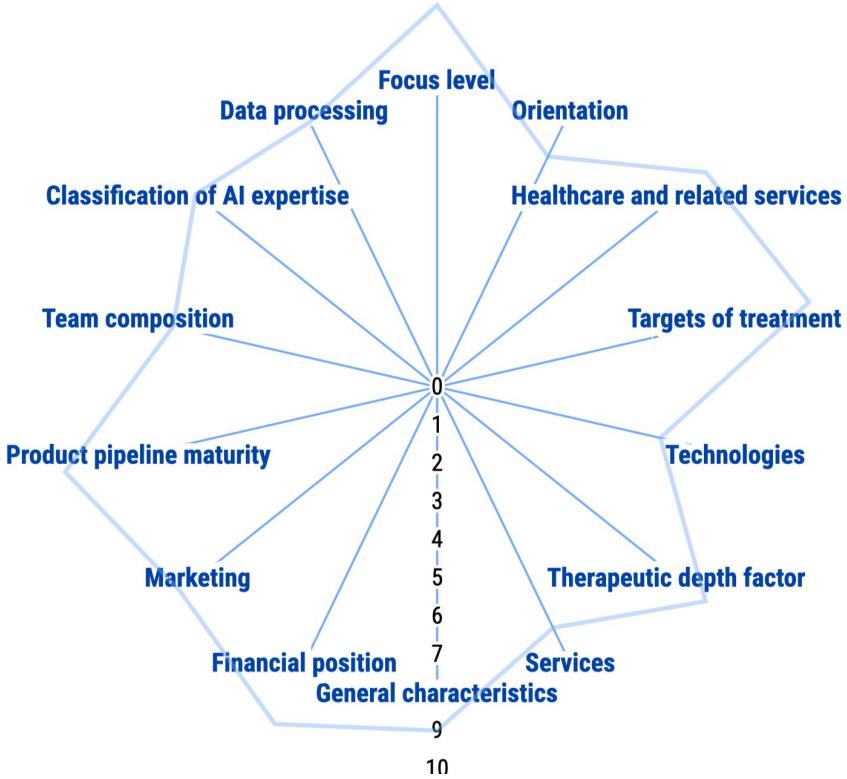


Abcam provides support for the life science research field. The company supplies the global life science community with different biological tools, such as antibodies, proteins, assay kits, engineered cell lines, and biochemical reagents. It also develops diagnostic and therapeutic applications.



Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
ABCM	0.31%	2.55%	388.47%	4.88

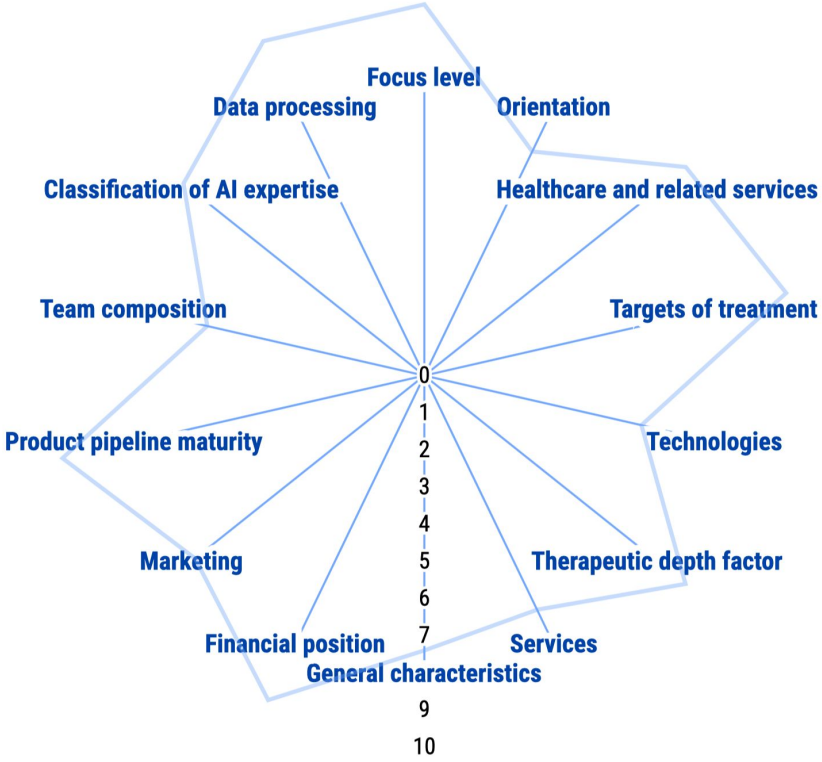
One Medical



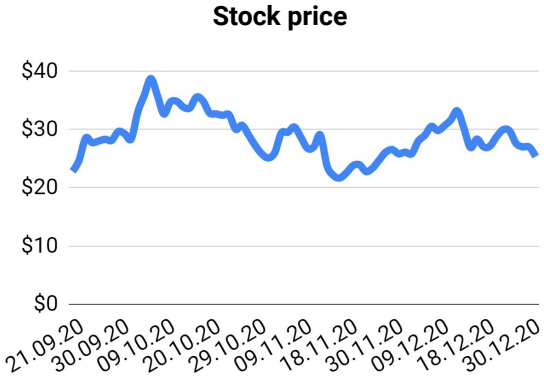
By providing easier access to medical consultations, treating a wide range of diseases and launching preventive care programs, One Medical attempts to provide a possible solution to humanity's health problems

Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
ONEM	0.41%	5.06%	83.48%	5.81

Amwell

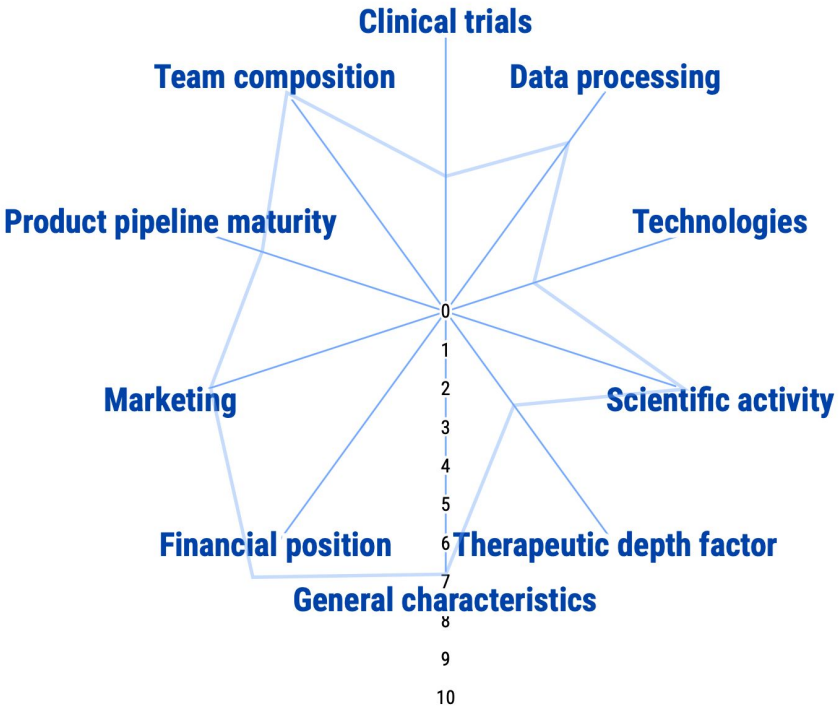


Being a telemedicine solution company, Amwell connects providers, insurers, patients, and innovators to deliver greater access to more affordable and higher-quality medical care.



Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
AMWL	0.32%	6.05%	10.56%	5.06

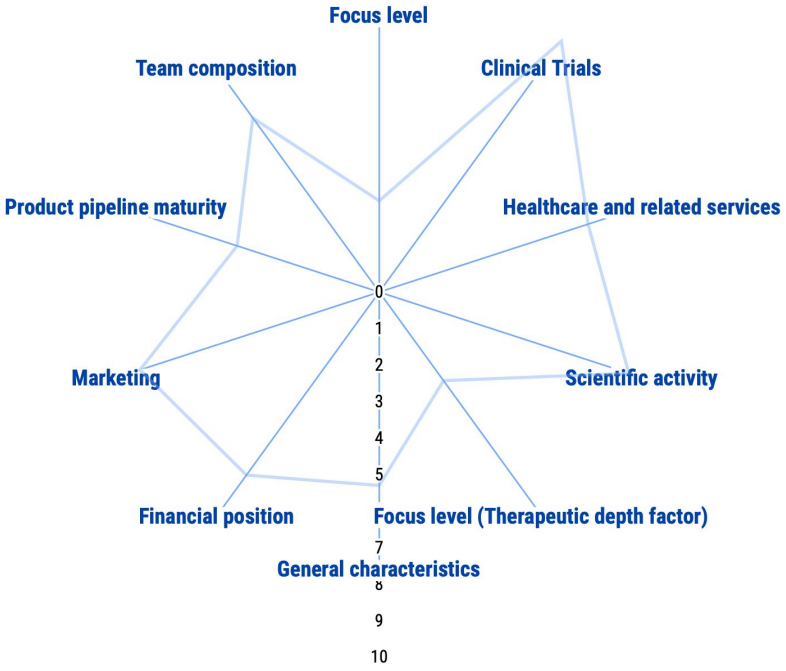
ALX Oncology



ALX Oncology is a clinical-stage immuno-oncology company that helps people with cancer. It attempts to identify molecules that can help the human immune system kill tumors.

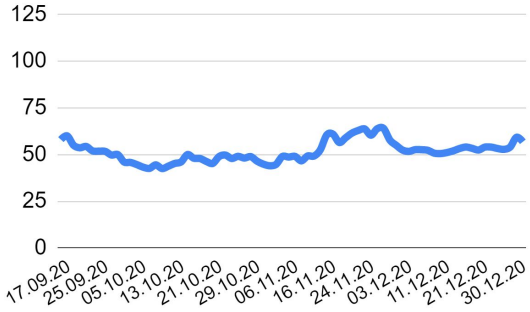
Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
ALXO	1.13%	6.67%	180.14%	2.99

Outset Medical



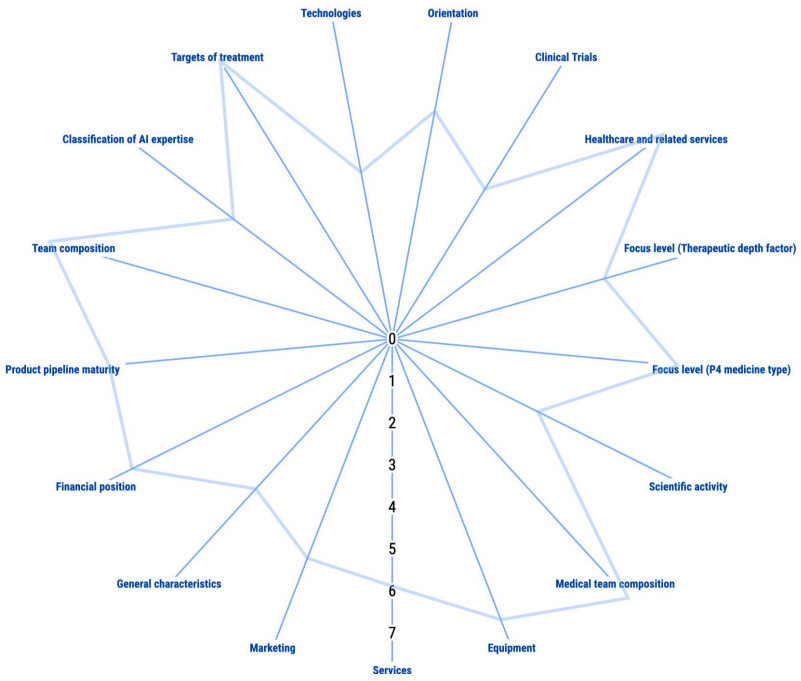
Outset Medical is a pioneering medical technology company that specializes in reimagining dialysis for patients and health care providers. It has invented Tablo, a small-sized mobile machine designed to simplify clinical and home dialysis for patients with kidney diseases.

Stock price

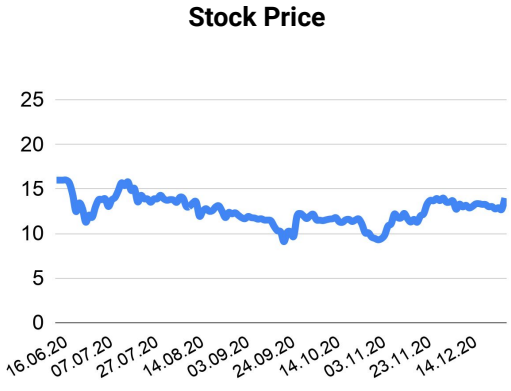


Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
OM	0.02%	4.38%	-2.03%	2.43

Genetron Health

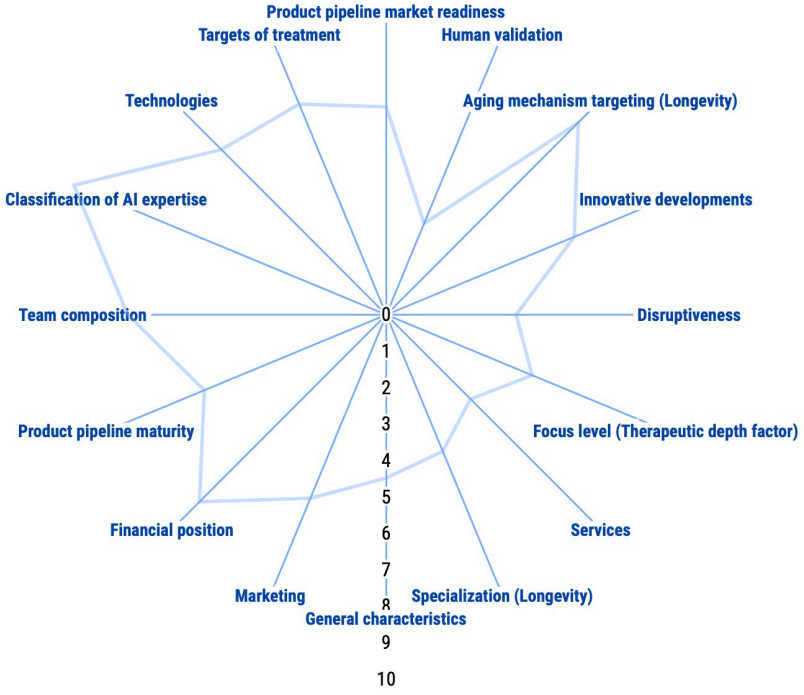


Genetron Health is a precision oncology company that provides genomic solutions in different areas, including early cancer screening, diagnosis, and monitoring, as well as biopharmaceutical services.

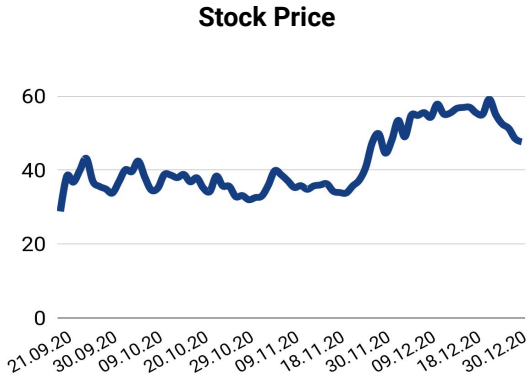


Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
GTH	0.01	4.81	-0.10	2.06

Kronos Bio



Kronos Bio is a biopharmaceutical company that develops new cancer transcriptomic targets and therapies aimed at blocking RNA-synthesis in tumors.

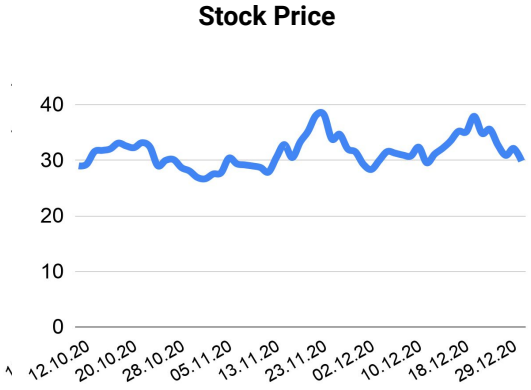


Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
CMPS	0.94	7.32	0.65	2.67

COMPASS Pathways

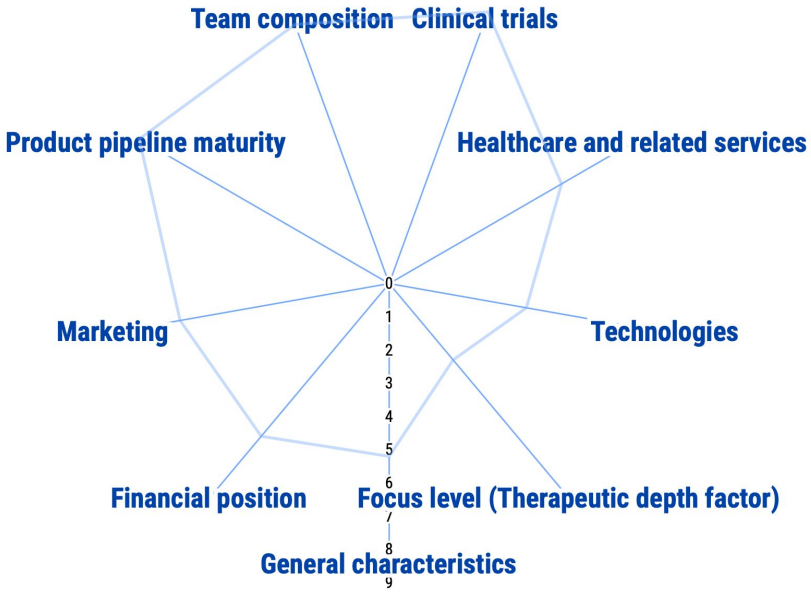
COMPASS Navigating Mental Health Pathways

COMPASS is a mental health care company that specializes in developing a psilocybin therapy meant to heal treatment-resistant depression states. Every member of the team has a mental health story, be it their own, or that of their friends or loved ones.



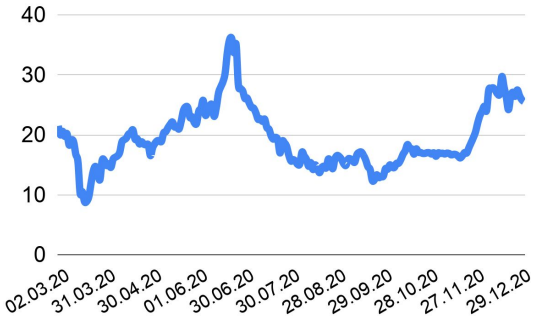
Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
KRON	0.31	5.35	0.03	1.00

Passage Bio



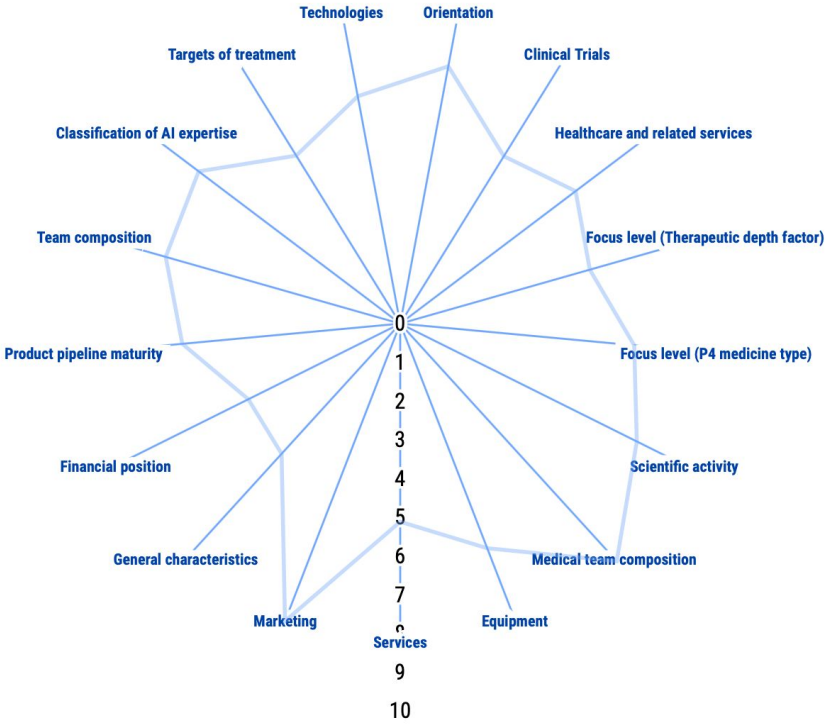
Outset Medical is a pioneering medical technology company that specializes in reimagining dialysis for patients and health care providers. It has invented Tablo, a small-sized mobile machine designed to simplify clinical and home dialysis for patients with kidney diseases.

Stock price

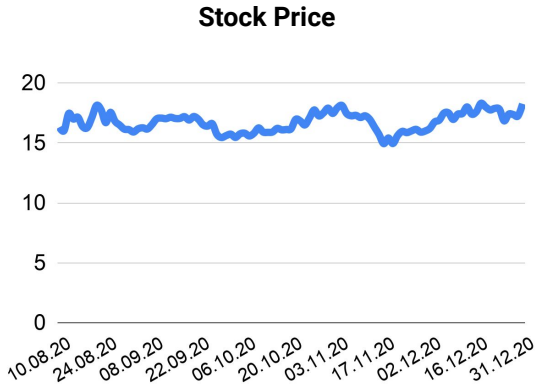


Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
PASG	0.27	6.24	0.19	1.16

Freeline Therapeutics



Freeline is a clinical-stage gene therapy company dedicated to improving the lives of people suffering from inherited, systemic and debilitating diseases, including hemophilia B and Fabry disease.



Ticker	Mean Daily Return	Volatility of Daily Returns	Growth After IPO	Capitalization (B$)
FRLN	0.05	2.86	0.12	0.77

Clinical Trials

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Clinical Trials: Introduction

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Clinical trials are experiments that do as a part of clinical research that **determines the safety and efficacy of new medications**, healthcare devices, diagnostic products or behavioural intervention.

The first step of drug trial is preclinical development, but it can not give 100% reliable information about pharmacokinetics, pharmacodynamics, toxicity for people. Scientists can receive only approximate conclusions from their preclinical research. That is why they **need to do human experiments**.

Also, clinical trials are separated into phases. Three phases are obligate and called **main phases,** including phase **I, II and III.** Two phases are additional (phase 0 and IV).

There are two types of clinical trials: **observational and interventional** study. Observational study means that the investigators only observe the subjects and measure their outcomes. The researchers do not actively manage the study. Interventional study means that the investigators give the research subjects an experimental drug or a medical device, etc. Then the researchers assess how the subjects' health changes.

Phases of Clinical Trials

Number of Phase	Purpose	Group Sizes
Phase 0	Pharmacokinetics and pharmacodynamics	10-15 people
Phase I	Toxicity and safety	Healthy 20-100 people
Phase IIa	Optimal Dosage with minimum side effects	50-300 patients
Phase IIb	Preliminary efficacy of the drug in comparison with placebo	50-300 patients
Phase III	Efficacy of the drug in comparison with standard treatment	300-3000+ patients
Phase IV	Pharmacovigilance and technical support of a drug, addition purposes	-

The Hallmarks of Aging

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Genomic Instability

Aging can be the consequence of increased DNA damage accumulation. This is due to physical, chemical, and biological agents, as well as DNA replication errors, spontaneous hydrolytic reactions, and reactive oxygen species (ROS).

Telomere Attrition

Telomeres are the chromosomal regions located on the ends of chromosomes. They tend to become increasingly shorter after each DNA replication. When this sequence ends, the cell dies. Telomerase deficiency in humans is associated with age-related diseases.

Epigenetic Alteration

Epigenetic changes involve alterations in DNA methylation, post-translational modification of histones, and chromatin remodeling.

Loss of Proteostasis

Proteostasis involves mechanisms for the stabilization of correctly folded proteins, and the heat-shock family of proteins, as well as mechanisms for the degradation of proteins. These processes tend to change during aging.

Deregulated Nutrient Sensing

Nutrient sensing include trophic and bioenergetic pathways, such as the insulin and IGF-1, signaling pathway and other systems (mTOR, AMPK, and sirtuins).

Mitochondrial Dysfunction

There is a noticeable reduction in ATP generation and an increase in electron leakage in the respiratory chain caused by aging.

Cellular Senescence

Cellular senescence can be defined as a stable arrest of the cell cycle. The accumulation of senescent cells in aged tissues can lead to age-related disease progression.

Stem Cell Exhaustion

Stem cells are cells from which all other cells with specialized functions are generated. There is a strong decrease in the number of stem cells during life. Recent studies suggest that stem cell rejuvenation may reverse the aging phenotype.

Altered Intercellular Communication

Neurohormonal signaling tends to be deregulated in aging as inflammatory reactions increase, immunosurveillance against pathogens and premalignant cells declines.

Anti-aging & Longevity Companies by Target

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Genomic Instability

The Sinclair Lab – Blavatnik Institute Genetics
JumpStart Fertility
ChromaDex

Telomere Attrition

Telocyte
cnio stop cancer
AGEX Therapeutics

Epigenetic Alteration

salk – Where cures begin.
turn.bio
iduna Therapeutics

Altered Intercellular Communication

Scholar Rock
rejenevie Therapeutics
Elevian
ALKAHEST
samumed

Loss of Proteostasis

ICHOR Therapeutics
Proclara Biosciences
sens research foundation – reimagine aging
COVALENT BIOSCIENCE, Inc – Nature-Made Catalytic Antibodies for Health
selphagy Therapeutics
LEUCADIA Therapeutics
UNDERDOG Pharmaceuticals
AURORA BIO
DENALI Therapeutics
GRIFOLS
Revel
pti PROTEOSTASIS Therapeutics, Inc.
Alterity Therapeutics

Deregulated Nutrient Sensing

UCSF
NUS National University of Singapore
biophytis – Live longer, live healthier

Mitochondrial Dysfunction

salk – Where cures begin.
sens research foundation – reimagine aging
animal Biosciences
Continuum Biosciences
Amazentis
Stealth Biotherapeutics
GenSight Biologics
MITOTECH SKQ

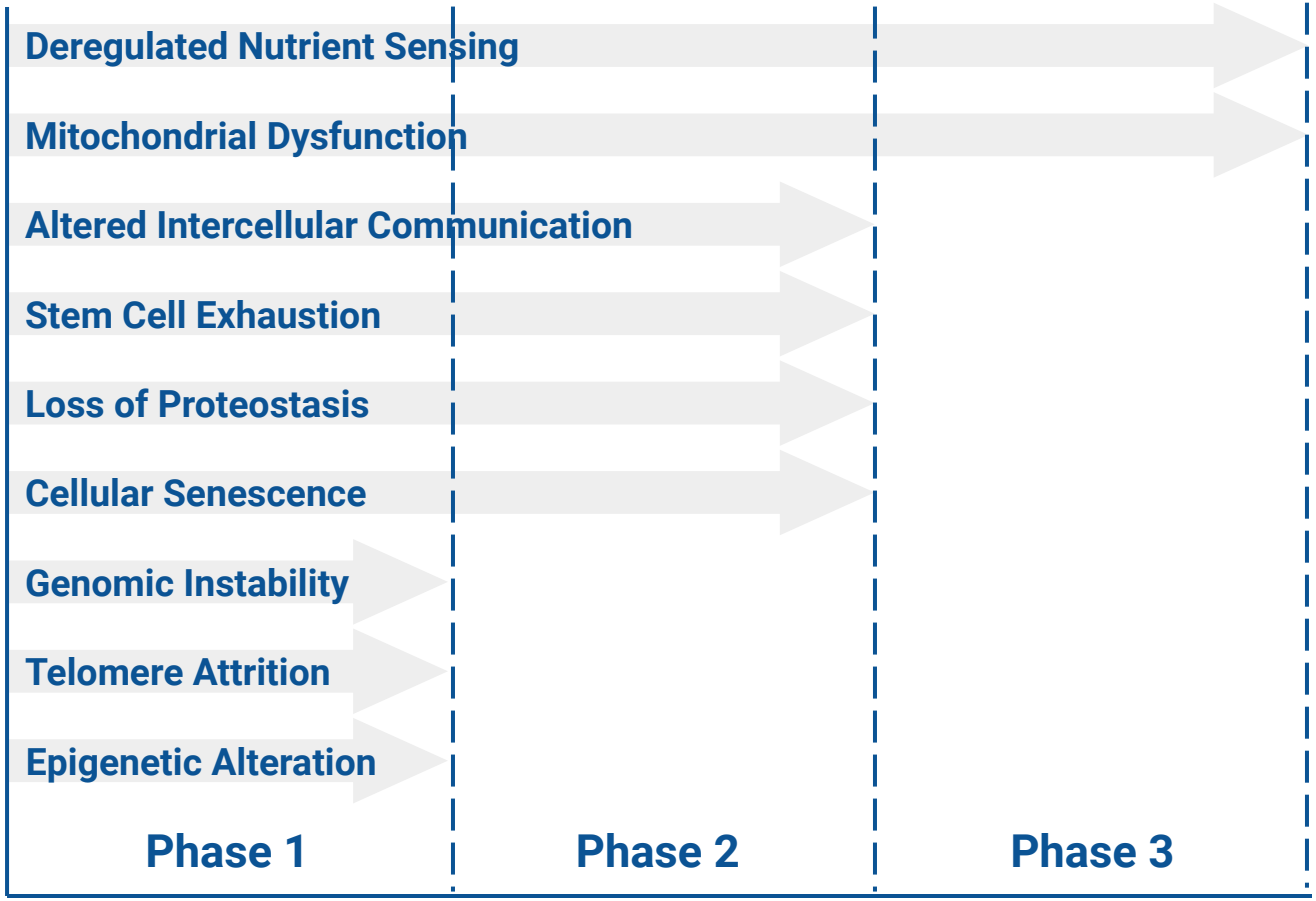
Cellular Senescence

Unity Biotechnology
Cleara
Scripps Research
Mayo Clinic
Oisín Biotechnologies
Antoxerene
senolytx
SIWA Therapeutics
Senisca
Atropos Therapeutics

Stem Cell Exhaustion

Intervene Immune
BlueRock Therapeutics
LYGENESIS
LongeVeron

Hallmarks of Aging Targeted in the Clinical Trials



Phase 1
21 trials

Phase 2
18 trials

Phase 3
7 trials

Longevity Drugs in Preclinical Development (1/3)

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The preclinical study is a stage of drug development that precedes clinical trials. It is necessary because there is a need to study the potential toxicity of a substance (or a device) before clinical trials.

The main goal of preclinical development is to test different characteristics of a potential drug, such as pharmacodynamics and pharmacokinetics, ADME (absorption, distribution, metabolism, excretion), and safe dosage for human testing.

There are two types of preclinical studies: *in vitro* and *in vivo*. ***In vitro*** means that biological agents (proteins, enzymes, cells, etc.) are outside of their normal biologic context. It is also called "test-tube experiments" because the experiment is conducted in the lab. ***In vivo*** means that an experiment is conducted on the whole living system (animal tests).

Revel	**Enzymes** which breaks glucosepane
CONTINUUM BIOSCIENCES	**Mitochondrial/Metabolic therapies** for aging
ANTOXERENE An Ichor Portfolio Company	**Senolytic drugs** to target the pathways of aging
ATROPOS THERAPEUTICS	**Senosuppressors**
JUMPSTART FERTILITY	**Egg quality restoration drugs**
sens research foundation reimagine aging	**GlycoSENS**: destruction glucosepane crosslinks to restore movement to the structural proteins
UNDERDOG PHARMACEUTICALS	**Cyclodextrins** to fight 7-ketocholesterol and remove artery plaques which causes heart diseases
AURORA BIO	**Peptope and CAR-M immunotherapies** against transthyretin amyloidosis
pti PROTEOSTASIS THERAPEUTICS, INC.	**USP14 inhibitors** to treat Alzheimer's and Parkinson's diseases

Longevity Drugs in Preclinical Development (2/3)

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cnio stop cancer	**Telomerase gene therapy**
AGEX THERAPEUTICS	**Telomerase therapy** & proprietary induced tissue regeneration **(iTR) technology**
salk Where cures begin.	**OSKM factors**: epigenetic cells' reprogramming into induced pluripotent stem cells (iPSCs) by expression Yamanaka genes
turn.bio	**OSKMLN** factors: epigenetic cells' reprogramming into induced pluripotent stem cells (iPSCs) by expression Yamanaka genes
ICHOR THERAPEUTICS™	**LYSOCLEAR**: an enzyme which distructs a lipofuscin
COVALENT BIOSCIENCE, Inc Nature-Made Catalytic Antibodies for Health	**Cardizyme** destroys transthyretin amyloid (misTTR) which causes age-related heart diseases
COVALENT BIOSCIENCE, Inc Nature-Made Catalytic Antibodies for Health	**Alzyme** destroys amyloid beta, a misfolded protein that forms Alzheimer's plaques
LEUCADIA Therapeutics	**Arethusta** promoting the flow of cerebrospinal fluid (CSF) through the brain to treat the Alzheimer's disease
selphagy THERAPEUTICS	**Restoring autophagy to older cells**
UCSF	**Klotho protein**, supressor of insulin and insulin-like growth factor 1 (IGF1)

Longevity Drugs in Preclinical Development (3/3)

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CLEARA	**FOXO4-DRI** causes apoptosis in the senescent cells	iduna THERAPEUTICS	**Epigenetic Reprogramming**: tissue rejuvenation
senolytx	**Senolytics to destroy senescent cells**	Berkeley UNIVERSITY OF CALIFORNIA	**Gene apheresis** to restore stem cells
sens research foundation reimagine aging	**MitoSENS** to prevent mitochondrial aging	SIWA THERAPEUTICS	**An immunotherapy** for removing cancer and senescent cells
animal BIOSCIENCES	**Mitochondrial/Metabolic therapies** for aging	SENISCA	**Modulating RNA splicing** to rejuvenate aged cells
OISIN® BIOTECHNOLOGIES	The plasmid-based senolytics **(SENSOlytics™)** to remove senescent cells	Elevian	**Blood factors** for rejuvenation

Longevity Drugs in Phase I Clinical Trials

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The Sinclair Lab BLAVATNIK INSTITUTE GENETICS	**NMN** boosted the ability to repair DNA damage
TELOCYTE A FUTURE BEYOND ALZHEIMER'S	**Gene therapy** for short telomere resortation
Proclara BIOSCIENCES	**General Amyloid Interaction Motif (GAIM)** to disrupt existing amyloid aggregates
DENALI THERAPEUTICS	**DTL201 and DTL151** to restore lysosomal function and treat the Parkinson's disease
DENALI THERAPEUTICS	**DNL747** reduces brain inflammation
DENALI THERAPEUTICS	**DNL343** restores RNA and protein function
NUS National University of Singapore	**Alpha-ketoglutarate (AKG)**

salk Where cures begin.	**J147** to treat the Alzheimer's disease and reverse some processes of aging
Amazentis	**Urolithin A** to prevent mitochondrial aging
UNITY BIOTECHNOLOGY	**UBX1325** for removing senescent cells
BlueRock Therapeutics	**CELL+GENE platform** to create Parkinson's disease treatment
Scholar Rock	**SRK-015** for spinal muscular atrophy (SMA) treatment
Intervene Immune	**Human growth hormone (HGH)** and **dehydroepiandrosterone (DHEA)** to regrow the thymus
Alterity THERAPEUTICS	**ATH434** to treat the Alzheimer's and Parkinson's disease

Longevity Drugs in Phase II Clinical Trials

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ChromaDex	**Nicotinamide riboside (NR)** boosted the ability to repair DNA damage	LYGENESIS	**The patient's own lymph nodes** for organs replacement
biophytis LIVE LONGER, LIVE HEALTHIER	**Sarconeos** to treat sarcopenia and age-related loss of muscle mass	LONGEVERON	**Allogenic mesenchymal stem cells (MSCs)** for treating age-related diseases
Stealth BIOTHERAPEUTICS	**Elamipretide:** a mitochondrial antioxidant	resTORbio	**RTB101** to boost the immune response and enhance lifespan
UNITY BIOTECHNOLOGY	**UBX0101** to remove senescent cells	ALKAHEST	**Chronokines** (plasma fractions) for rejuvenation
Scripps Research	**Quercetin and Dasatinib** to destroy senescent cells	rejenevie THERAPEUTICS	**Hematopoietic stem cells (HSCs)**
CRATUS	**Mesenchymal stem cell (MSC) therapy** to treat age-related frailty	MAYO CLINIC	**Fisetin** to remove senescent cells

Longevity Drugs in Phase III Clinical Trials

There are three main phases of clinical trials, of which Phase I is the earliest one. **Phase I Clinical trials** is necessary to determine a safe dosage for healthy people (a group consists of 10 people). **Phase II** is the testing of a drug on volunteers to assess its efficacy and side effects (100-300 participants). **Phase III**, the largest clinical trial, is held to assess the efficacy, effectiveness, and safety of a drug (300 - 3000 participants with a specific disease).

Samumed's Lorecivivint - a drug is safe and well-tolerated during Phase II and can enter Phase III. This phase is intended to support an eventual New Drug Application and the potential approval of lorecivivint as a treatment for osteoarthritis.

SkQ1 (Mitotech) - a drug demonstrates statistically significant superiority over placebo, is comfortable and well-tolerated and causes no unexpected or serious ocular adverse events. It also enters Phase III and initially demonstrates positive results.

Grifols reports that patients with moderate Alzheimer's disease have experienced a 61% reduction in disease progression and a 71% reduction in symptoms.

MITOTECH SKQ	samumed	GRIFOLS
SkQ1: a mitochondrial antioxidant	**Lorecivivint** for restoring the Wnt signaling pathway	**AMBAR:** a plasmapheresis technique to treat the Alzheimer's disease
Mitochondrial Dysfunction	Altered Intercellular Communication	Loss of Proteostasis

Finished Phase III Clinical Trials

GeneSight Biologics is a gene therapy company that specializes in the treatment of severe inherited retinal and central nervous system diseases.

Its two main products (GS010 and GS030) are designed to treat rare diseases, such as Leber Hereditary Optic Neuropathy (LHON) and Retinitis Pigmentosa (RP).

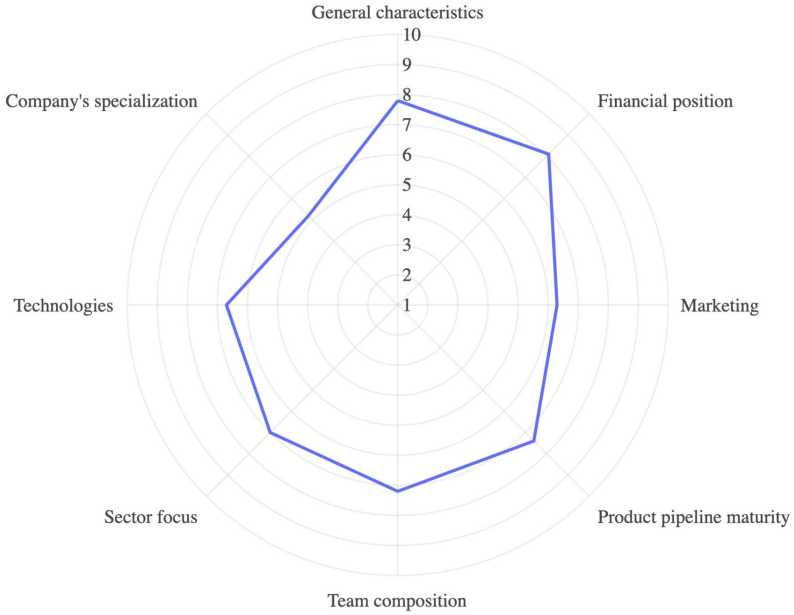
December 12, 2020: **GS010 passed Phase III Clinical Trials** and demonstrated very impressive results in the treatment of Leber Hereditary Optic Neuropathy (LHON), an inherited mitochondrial genes disease of the eye that causes blindness.

In 2020, GeneSight's therapy helped 37 participants. It is a AAV2 gene therapy that contains DNA regions that can encode wild-type ND4 protein and restore mutated proteins.

Ticker	Capitalization	Number of Investors	Number of Articles
SIGHT.PA	$405M	15	27

GenSight BIOLOGICS

GS010 to treat the Leber Hereditary Optic Neuropathy



Key Takeaways

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Major Observations for 2021: Key Business Takeaways

1. As a result of aging and the upcoming Silver Tsunami, **there has been an increase in interest in the Longevity industry.** Currently, the **size of the market** is estimated at **$34 trillion.** The main players in the market are **national healthcare companies** and **longevity-focused financial companies.** Longevity-focused biomedicine companies with a smaller market share have been the main focus of longevity venture investors.

2. Among all of the industry's sectors, **P4 Medicine** (Precision, Preventive, Personalized, Participatory) is the largest one in terms of the funds raised and the number of companies involved. Accounting for 50% of the entire market, it represents stable growth.

3. Region wise, the **US is an absolute industry leader**. By the percentage of longevity-focused companies (**62%**), it is far ahead of **Europe (**21%), and **Asia** (9%).

4. Despite a small number of companies, **investments in longevity-focused companies in China and India have increased** (and so has the size of the companies).

5. The Silver Tsunami phenomenon poses increased risks for financial institutions, such as pension funds and insurance companies. Two scenarios here are possible: optimistic and pessimistic one. In the first case scenario, most of the institutions will adapt to the new reality and transform their business models. In the second case scenario, they will not be able to adapt to aging population challenges due to lack of resolve and technological capabilities.

6. **The COVID-19 pandemic appears to be a catalyst for the Longevity Industry growth. Compared to the previous year, it has triggered a growth of more than 30%.**

Observations in 2021: Key Financial and Investment Takeaways

1. Due to the COVID-19 pandemic, **the biotech and longevity sectors are on the rise**. During 2020, we witnessed multiple medium and large funding rounds for biotech and longevity companies, especially for those of them that focus on drug development.

2. In 2019-2020, more than 500 **longevity-focused companies closed large-sum late-stage venture capital rounds (B, C, and D)**. Some of them are now busy developing candidates for clinical stage trials. It is expected that some of them will become commercially available in 2021-2022.

3. 2020 was marked by **19 IPOs** in the Longevity sector.

4. 2020 saw **a general "biotech IPO boom"**, which was partly caused by the coronavirus pandemic. The latter — directly and indirectly - dramatically impacted the longevity industry.

5. The closing of IPOs **will attract a significant number of non-biotech investors looking to enter the Longevity sector**.

6. Despite the crisis, publicly traded companies demonstrate rapid growth, having achieved $62.8 billion of cumulative capitalization or a 266.6% growth rate.

7. Currently, VC funds categorize longevity companies according to their seed, series A, series B and other parameters. The stage of a company's development will become less important, while **TRL levels and the level of technological development (assessed by other tangible metrics) will be of far greater significance**. They will ensure data-driven analysis and make it possible to perform certain mathematical calculations of the value of a portfolio company.

Key Technology Takeaways

1. Over the recent years, **significant progress has been achieved in aging research** (mainly in animal studies). As a result, longevity has become a complex and multidimensional science. Its diverse technological offshoots, such as geroscience, geriatrics, regenerative medicine, and precision medicine, are all developing simultaneously. This serves as a foundation for the global Longevity Industry, which will probably be humanity's largest industry by the year 2040.

2. **AI-driven biomedical research and development efforts are now more technologically mature and can be successfully used in aging research.** The key power of AI lies in its ability to accelerate real-world implementation of longevity science, such as drug discovery, biomarkers discovery, new longevity and genes identification, and bring personalized medicine to clinics based on an individual patient's records.

3. Currently, the main focus of global public health efforts is on increasing human healthspan. Achieving this requires successful **treatment and prevention of age-related diseases**, such as cancer, neurodegeneration and cardiovascular diseases.

Obstacles That Still Remain

1. Application of discoveries in animal aging to humans requires **better biomarkers** of disease risk and responses to interventions, and **increased use of electronic health records, biobank resources and cohort studies**. Absence of validated biomarkers of risk of age-related diseases poses challenges for the development of anti-aging drugs. There is still no consensus among scientists regarding biomarkers of a biological age.

2. **The ability of AI to make accurate predictions depends on data availability.** A major concern in the application of AI technologies in healthcare is related to the acquisition, generation, and use of health data. Regulatory efforts are needed to ensure proper flow and use of healthcare records.

3. There is a **shortage of financial resources necessary for the development of public health programs** capable of reducing the risk of age-related diseases. Many health promotion strategies lack scientific and clinical evidence of their efficacy.

4. It is crucial to shift focus from treating individual diseases to developing medical interventions capable of **extending the human lifespan**.

Longevity in the Global Context

Driven by the declining fertility rates and improvement in health and longevity, human populations are rapidly aging. The world is likely to have 1 billion elderly people by 2030. The most rapid increases in the proportion of people aged 65 and over are taking place in developing countries, with the most dramatic changes being observed in East Asia. There, life expectancy at birth has increased from less than 45 years (in 1950) to more than 72 years. In the near future, the elderly population is expected to grow fastest in Northern Africa. In contrast, the projected increase is relatively small in Australia, New Zealand, Europe and Northern America.

Among the developed countries, Hong Kong and Japan have the highest life expectancy rate at birth (84.7 and 84.5 years, respectively). Despite spending less on health and social care (compared to other developed economies), Hong Kong demonstrates superior social indicators — adolescent birth rate, youth involvement in education or employment, homicide rate and incarceration rate. Its superb health indicators, and more specifically, life expectancy and infant mortality rate, may be considered key longevity-related factors.

In terms of investments and number of aging research institutions (almost 50% of the total number worldwide), **the US is an undisputed leader in the longevity industry**. Suffice it to recall that the majority of major longevity-focused companies are based in the US. This contrasts sharply with health disparities which are due to socio-economic inequalities.

Among EU countries, Italy (22.8 %), Greece (22.0 %), Portugal (21.8 %) and Finland (21.8 %) had the highest percentage of individuals aged 65 and over in 2019. In their turn, Ireland (14.1 %) and Luxembourg (14.4 %) had the lowest percentage. It is expected that the percentage of individuals aged 65 and over will increase and account for 29% of the entire population by 2060.

The demographic shift is affecting each and every aspect of social life, from health system pressures to economic impact on public finances. It presents opportunities to individuals and society; however, it also poses challenges which have to be addressed in government policies. That is precisely why redesigning pension systems has become a priority in many countries.

About Aging Analytics Agency

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Aging Analytics Agency is primarily interested in strategic collaboration with international corporations, organisations and governments of countries in longevity-related projects and initiatives.

Aging Analytics Agency is open for cooperation with strategic clients via a variety of approaches, including:

- Conducting customised case studies, research and analytics for internal (organizational) use, tailored to the precise needs of specific clients;
- Producing open-access analytical reports;
- Offering customised analysis using specialised interactive industry and technology databases and IT-platforms.

In certain specific cases, and if it meets our interests, Aging Analytics Agency is open to co-sponsoring research and analytics for the production of internal and open-access industry reports, as well as special case studies for a variety of governmental, international and corporate clients. Their topics may include Longevity, the Longevity Financial Industry, Longevity Policy and Governance, as well as the development and execution of full-integrated National Healthy Longevity Development Plans tailored to the specifics of national governments and economies.

www.aginganalytics.com info@aginganalytics.com

About Aging Analytics Agency

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Aging Analytics Agency will serve as the main source for data for the soon-to-be-launched specialized Longevity index hedge fund **Longevity.Capital**, helping to establish pragmatic portfolio company valuation and efficient due-diligence procedures, and to structure advanced investment strategy in the overly-complex Longevity industry.

Moreover**, Aging Analytics Agency** is the major source of market intelligence for **Longevity Card** and **Practical Longevity** (Proprietary Project on Personal Life Extension).

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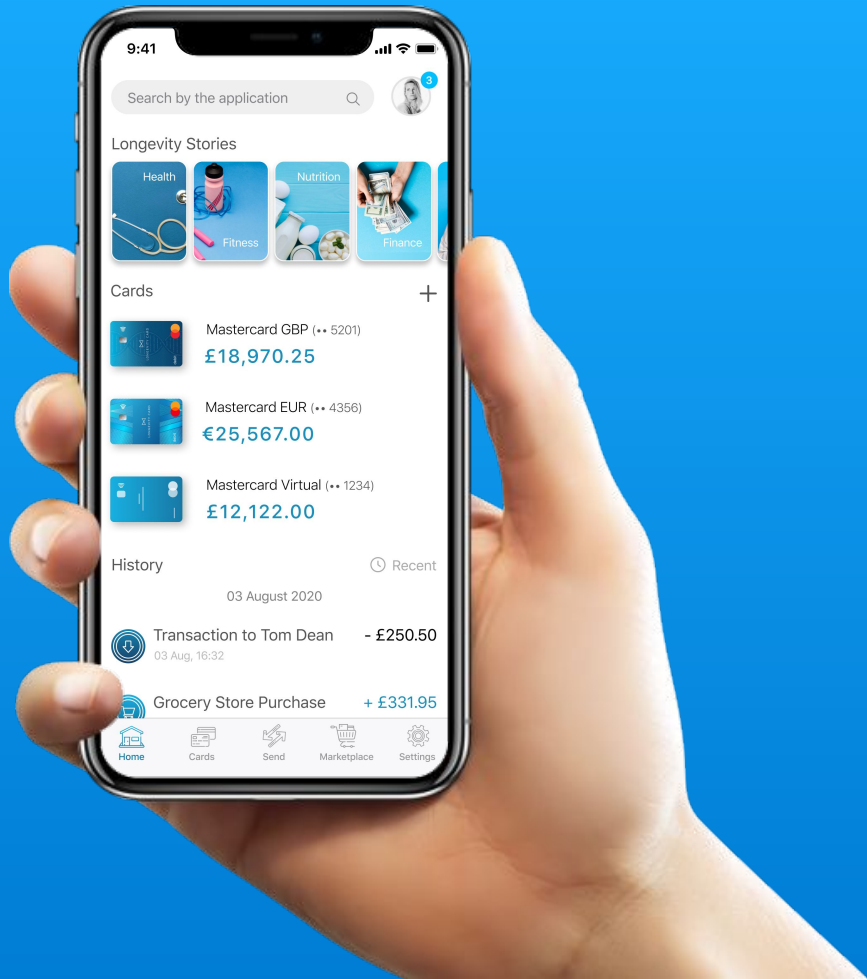
LONGEVITY CARD®

HEALTH IS THE NEW WEALTH



ACCOUNT FEATURES

UK IBAN

MULTI CURRENCY ACCOUNTS

DEBIT CARD

MONEY TRANSFERS

CASH LOAD

LONGEVITY MARKETPLACE

PERKS

FAST SIGN UP

REAL-TIME NOTIFICATIONS

TRAVEL INSURANCE

BUSINESS ACCOUNTS

24/7 SUPPORT

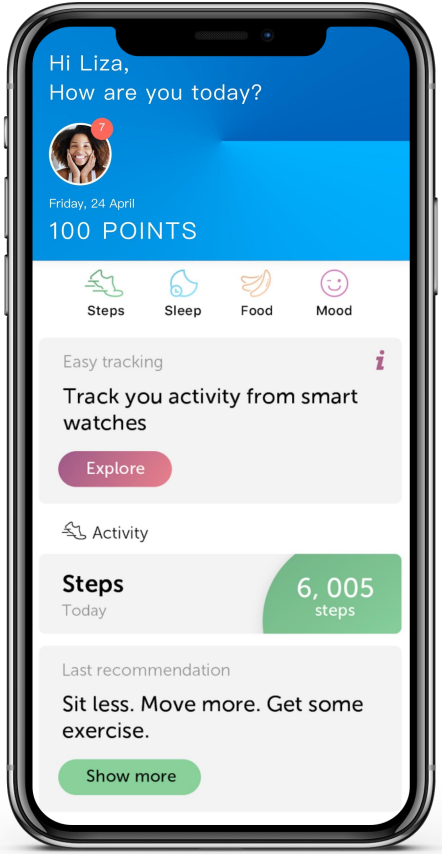
HEALTHTECH INTEGRATION

HEALTHSPAN AND FITNESS GAMIFICATION

LONGEVITY POINTS

DAILY ACTIVITY ANALYSIS

SLEEP ANALYSIS



AI POWERED PERSONALISED RECOMMENDATIONS

WEARABLES COMPATIBLE

LONGEVITY STORIES

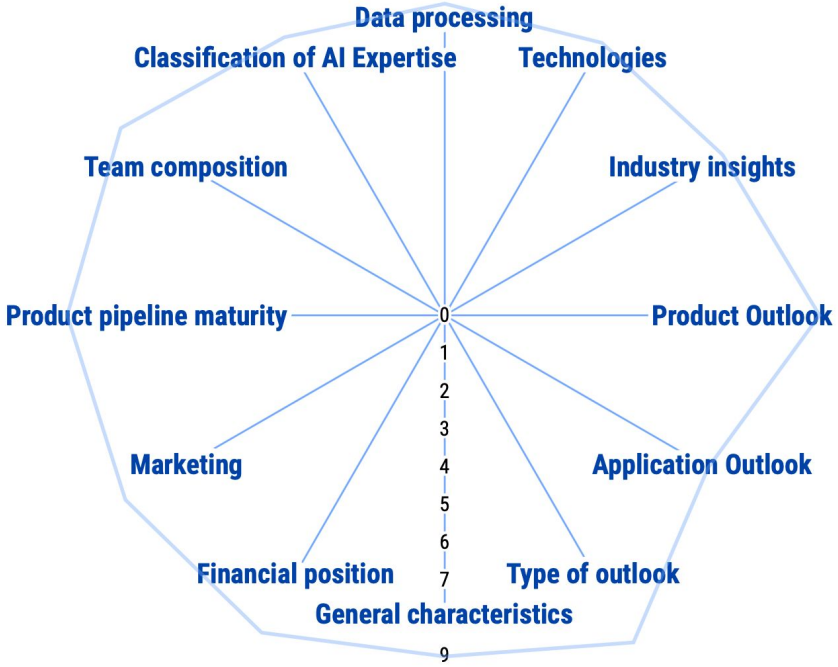
NUTRIENT TRACKING

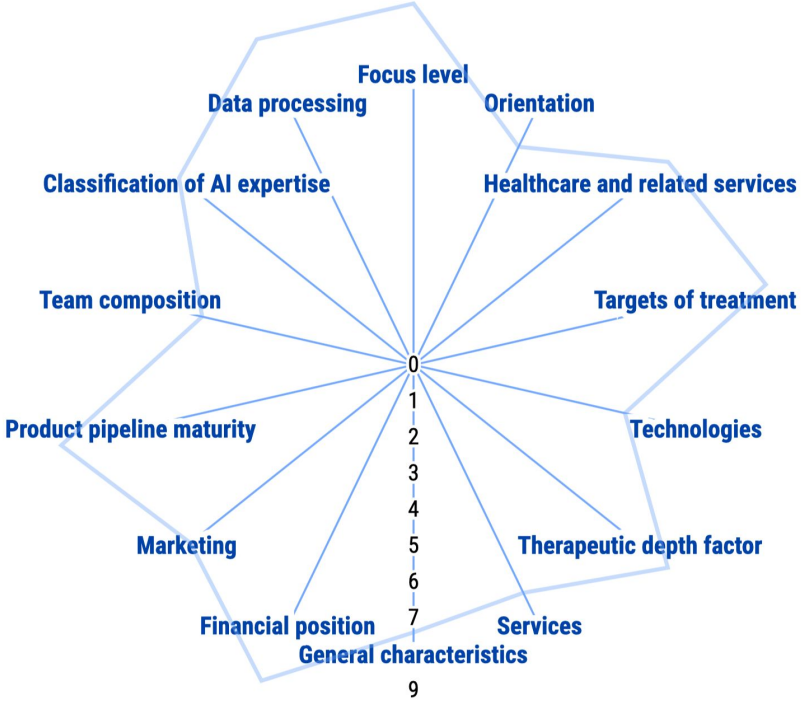
Longevity Investment: Big Data Analytics Dashboard

Multiparametric Assessment Analysis (Using Big Data Analytics Platform)

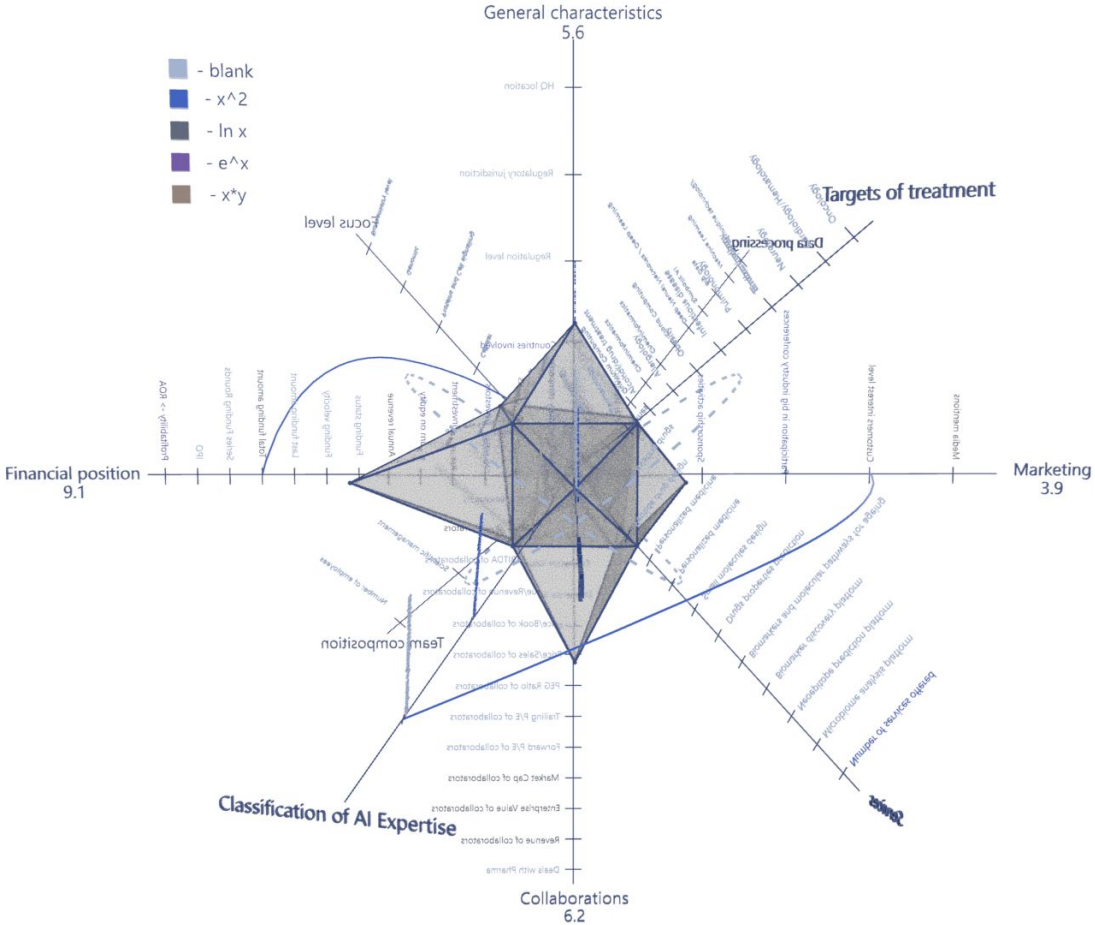
Aging Analytics Agency offers a state-of-the-art AI-based **SWOT analysis system** covering **6000+** companies that are divided into 12 categories.

By comparing a company's multiple parameters in 12 vectors of its business development, our system makes it possible to conduct its initial data-driven due diligence **instantly, automatically, and holistically**. The results of the analysis are presented in easy-to-perceive 2D and 3D radar charts.

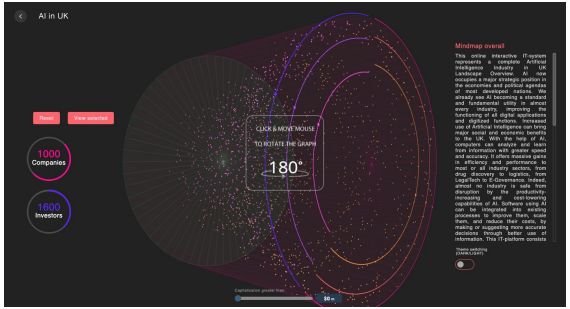




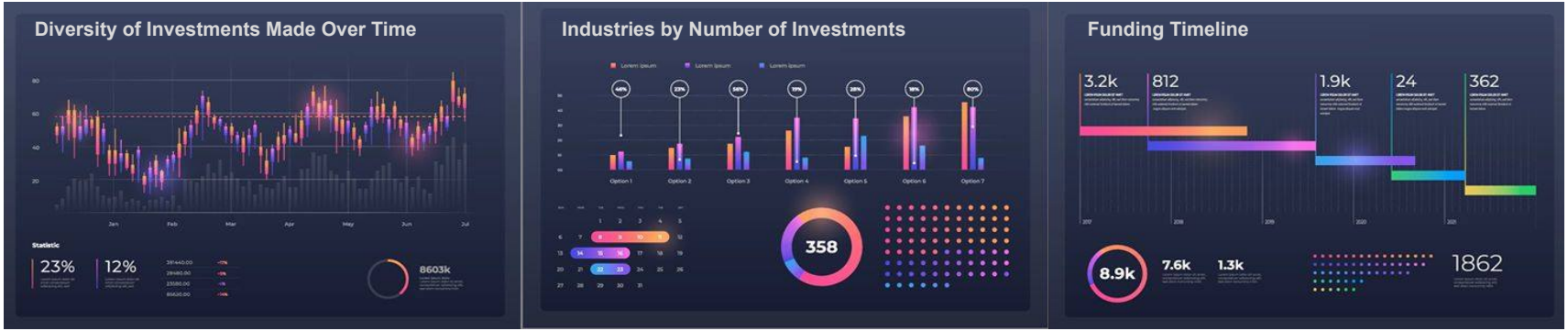
Multiparametric Assessment Analysis (Using Big Data Analytics Platform)



Aging Analytics Agency:
Upcoming Projects and Analytical Tools



3D Visualisation Prototypes



Longevity Investment Big Data Analytics Dashboard

Longevity Industry Big Data Analytical Dashboards

Dashboard Overview

Aging Analytics Agency is working on a sophisticated cloud-based engine designed for advanced market and business intelligence in various segments of the longevity industry. It includes a data mining engine, infrastructure for expert data curation, and advanced visualization dashboards, including mindmaps, knowledge graphs, and 3D visualizations. It also offers data-driven insights into the trends and companies in the longevity industry, SWOT analysis of the most promising entities and technologies, investment advisory, business and technical due-diligence.

Matching tool	Machine learning for database extrapolation	Dynamic SWOT analysis representing evolution of a company
Companies database	Machine learning and deep neural networks for companies clusterization	Interactive industry mindmaps
Investors database	Machine learning for financial indicators predictions	Real-time financial data analytics platform for AI in pharma corporations
SWOT analysis	Interactive AI-based scenario analysis and financial planning	AI in pharma financial instruments analytics

Database, AI and ML algorithms overview	
Parameters	400 parameters with appropriate weights combined into 20 vectors
Data points	8 000 000 data points which are being updated permanently
Algorithms	Deep neural networks, polynomial formulas with mathematical transformations, regression models
Data aggregation	Automatized parsing, extrapolation using machine learning, feedback from companies

Who Can Benefit

- Investment institutions, funds, investment banks, family offices;
- Private and public companies in pharma/biotech space
- Research institutions, universities
- Technology vendors and contract research organizations
- Startup hubs, accelerators
- Consulting companies and agencies

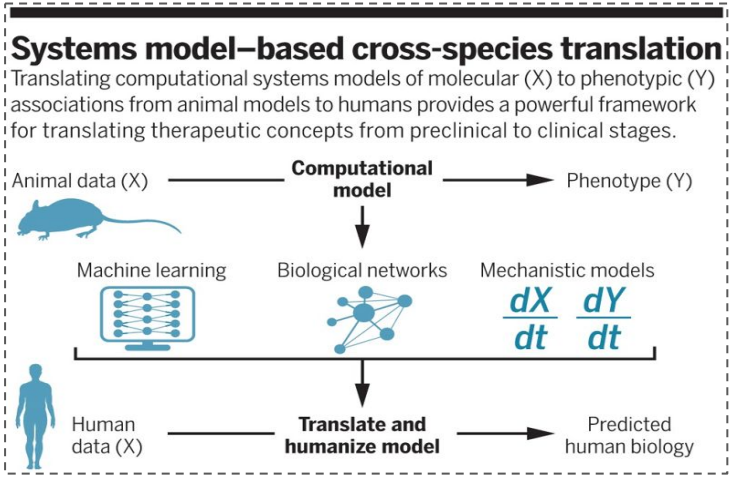
Tangible Metrics to De-Risk Investments in Longevity Startups

Investment decisions practices in the longevity industry can be essentially enhanced through the application of the biomarkers of aging. Concrete and precise metrics of human aging can assist investors in differentiating between overvalued hype-driven startups without any proofs of success in fighting human aging and promising businesses which are producing tangible anti-aging results applicable for humans.

Given the enormous differences between the biology of humans and the biology of common model organisms like mice, combined with the higher degree of biological complexity as it pertains to ageing vs. single diseases, we can expect the clinical translation failure rate in the Longevity Industry to be much higher than the already-enormous failure rate in traditional BioTech.

New approaches to scientific due diligence and the validation of results for longevity-focused companies are needed to ensure protection against company and industry devaluation. However, there are a number of existing approaches that can be used by investors to de-risk longevity investments.

The use of biomarkers of aging and longevity constitutes the most market-ready and validated means of proving efficacy in humans. It can also serve as a basis for demonstrating human-validated results by longevity companies and startups. A wide array of single biomarkers and panels of biomarkers of Longevity exists in a market-ready form, and should be adopted by longevity investors for due-diligence in order to create a more modern, sophisticated and robust method of preliminary validation of therapeutic safety and efficacy.



In addition to biomarkers, there is also a large number of other modern approaches capable of providing preliminary indicators of human validation. They can be used to create a coordinated framework which will provide investors with greater confidence in the likelihood of clinical translatability. These include:

- In silico human modeling
- In vitro tests using human cells and tissues
- Human-animal chimeras (e.g., human-mouse chimeras) for safety, toxicity and efficacy testing. This approach is already common in immuno-oncology research, and a wide array of validated approaches can be applied for testing of aging-focused interventions.
- In vivo administration of sub-therapeutic doses using microfluidic chips (i.e., in vitro “skin-on-a-chip” testing).

Biomarkers of Longevity

Approved for Clinical Use - 41
Research Use Only - 45
Healthcare-Ready - 33

2nd edition.
Current Status, 2021

Approved for Clinical Use

Healthcare-Ready
(waiting for clinical approval)

Research Use Only

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Biomarker Panels

- InsideTracker Inner Age
- InsideTracker Ultimate Plan
- RGCC aCGH RGCC
- RGCC Immune-Frame
- Genova Diagnostics Comprehensive Adrenal Stress Profile
- ARUP B-Cell Memory and Naive Panel
- ARUP Natural Killer Cell and Natural Killer T-Cell Panel
- 23andMe Health + Ancestry Service
- ARUP Carnitine Panel
- ARUP Cytokine Panel, TH1
- ARUP Hepatic Function Panel
- ARUP Regulatory T-Cell Panel
- ARUP Cytokine Panel
- Genova Diagnostics Oxidative Stress Analysis 2.0
- Fluids iQ Adrenal Check
- Genova Diagnostics Adrenal Stress Profile
- Genova Diagnostics Advanced MethylDetox Profile
- Genova Diagnostics Advanced MethylDetox Profile + Thelomere Length
- Diagnoptics AGE-Reader mu Test
- Mayo Clinic Laboratories Cytokine Panel
- biobank Biomarker Panel
- WellnessFX Premium
- Aging Theraputic 1.0
- Labrix 10 Hormone Saliva Test Kit
- Wellness Genomics Anti-Aging #4 Comprehensive Blood and Urine Test Panel
- DNA Genotek Female/Male Saliva Profile II - Test Kit for 6 Hormone Level Imbalances
- LifeExtension Healthy Aging Panel (Comprehensive)
- Genova Diagnostics CardioGenomic Plus Profile
- Genova Diagnostics ImmunoGenomic Profile
- Genova Diagnostics NeuroGenomic™ Profile
- Genova Diagnostics Metabolic Analysis Profile (Organic Acids)
- PhysioAge PhysioAge Biomarkers of Aging Test
- smartDNA smartGUT™ Microbiome Test
- cerascreen Genetic Age Test
- VIOME Viome Gut Intelligence™ Test
- Microba Microba Insight™
- GlycanAge GlycanAge Test
- TFTAK Gut Microbiota Biohacker
- TAmiRNA toxomiRTM biomarkers of toxicity
- TAmiRNA osteomiRTM validated bone biomarkers
- TAmiRNA thrombomiRTM biomarkers of platelet function
- Olink Proteomics Metabolism Panel
- Olink Proteomics Immune Response Panel
- Olink Proteomics Inflammation Panel
- Olink Proteomics Organ Damage Panel
- Olink Proteomics Cardiovascular II Panel
- Olink Proteomics Cardiometabolic Panel
- Olink Proteomics Oncology III Panel
- Olink Proteomics Oncology II Panel
- Olink Proteomics Neurology Panel
- Olink Proteomics Neuro Exploratory Panel
- Olink Proteomics Cell Regulation Panel
- Olink Proteomics Cardiovascular III Panel
- myriad HumanMAP v.2.0
- myriad MetabolicMAP v.1.0
- myriad CardiovascularMAP v.3.0
- myriad DiscoveryMAP v.3.3 Panel
- myriad AngiogenesisMAP v.1.0
- myriad NeuroMAP v.1.0
- myriad ImmunoMAP v.1.0
- myriad Explorer MAP v.1.0
- myriad InflammationMAP v.1.0
- myriad CytokineMAP B
- myriad CytokineMAP A
- BioLegend LEGENDplex Human CD8/NK Panel
- BioLegend LEGENDplex Human B Cell Panel
- MIRXES MiRXES ID3EAL miRNA Assay
- cisbio Phospho-FOXO (Ser128) cellular kit
- abcam Senescence Detection Kit
- SPIDER-BGal
- Cytometry OMIP-004
- Cytometry OMIP-018
- Cytometry OMIP-039
- Salivary Cytokine Panel
- BioLegend LEGENDScreen Human PE Kit
- BioLegend LEGENDplex Human Th Cytokine Panel
- Cytometry OMIP-027
- Cytometry OMIP-007
- Cytometry OMIP-029
- Human v3 miRNA Assay

Digital Panel Platforms

- Babylon Health Platform
- Ada Symptom Checker app
- CarePredict Platform
- Health Reviser Platform
- Google's DeepMind Health AI Platform
- Centers for Age Control AgeMeter
- Blood Chemistry Calculator
- AI-Powered Radiology Assistant
- MEDIAGE™ Biological Age Measurement System
- KenSci Platform
- Enlitic Platform
- Aging.AI
- PathAI Platform
- Buoy Health Platform
- PhotoAgeClock
- Haut.AI Skin Health
- Digital Nutrition Platform
- Proscia Platform
- Freenome Platform
- BenevolentAI Platform
- Better Therapeutics Platform
- Tempus Platform
- ICabonX Platform

Single Biomarkers

- ARUP CD4+ T-Cell Recent Thymic Emigrants
- ARUP CD57+ NK Cells, Peripheral Blood by Flow Cytometry
- ARUP CD21 (Dendritic Cell) by Immunohistochemistry
- TruDiagnostic TruAge™ Epigenetic Test Kit
- Cell Science Systems Telomere Length Test
- Zymo Research DNAge™ Epigenetic Aging Clock
- Chronomics EpiHealth
- BioViva DNAge® Test
- EpiLiver
- TeloYears + Advanced Ancestry Tests
- Osiris Green Epigenetic Age Analysis Version 2.0
- EpiAging
- Targeted Seq. for DNA Methylation Analysis
- EpiSocialpsych
- Life Length Telomere Length and Biological Age Testing
- EpiBreast

www.longevity.international/biomarkers

Longevity Finance: Big Data Analytics Dashboard

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Longevity Finance
Big Data Analytics Dashboard

Market Intelligence

Longevity Finance Market Intelligence

- SWOT Analysis
- Interactive Mindmaps
- Market Intelligence

Interactive Mindmaps

View More

Dashboard Parameters

DATA POINTS	PERSONALITIES	CORPORATIONS
100019	2000	1000
STARTUPS	**INDUSTRIES**	**SECTORS**
5000	15	50

SWOT Analysis

View More

Longevity Finance Market Intelligence

- Pre-Subscribe for Beta
- Sponsorship Opporrtunities
- Request Custom Analytics

Search Engine

Longevity Finance Search Engine

- Interactive Database
- Dynamic Network Diagrams
- Competitor Search

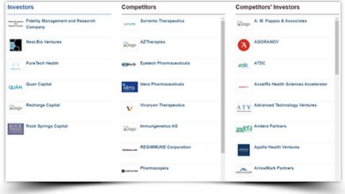
Interactive Database

FinTech | WealthTech | InsurTech

Interactive Network Diagrams

FinTech | WealthTech | InsurTech

Competitor & Investor Search



FinTech | WealthTech | InsurTech

Longevity Finance Search Engine

- Personalities
- Corporations
- Startups
- Investors

Longevity Governance: Big Data Analytics Dashboard

AGING ANALYTICS AGENCY

Longevity Governance
Big Data Analytics Dashboard

Market Intelligence

Longevity Governance Market Intelligence

- Full Analysis
- Interactive Mindmaps
- SWOT Analysis
- Dynamic Charts

Full Big Data Analysis

View More

Dashboard Parameters

DATA POINTS	PARAMETERS	REGIONS
12000	240	50
LAYERS OF FRAMEWORK	**DYNAMIC CHARTS**	**SWOT ANALYSIS PROFILES**
6	100	50

SWOT Analysis

View More

Longevity Governance Market Intelligence

- Pre-Subscribe for Beta
- COVID-19 Dashboard
- 3D Visualization

Search Engine

Longevity Governance Search Engine

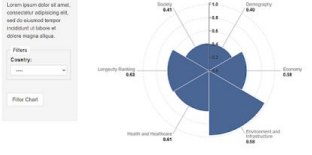
- Benchmarking Charts
- Major Trends
- Practical Recommendations
- Big Data Framework

National Healthy Longevity Interactive MindMaps

View More

Longevity Progressivness 3D Visualization

Longevity Progressiveness Benchmarking Charts



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Longevity Governance Search Engine

- Health-Adjusted Life Expectancy (HALE) Gap and Life Expectancy
- Health-Adjusted Life Expectancy (HALE) Benchmarking

Artificial Intelligence in Pharma: Big Data Analytics Dashboard

DEEP PHARMA INTELLIGENCE

Deep Pharma Intelligence
Big Data Analytics Dashboard

Landscape Analytics

AI in Pharma 2020 Industry Landscape

- Mindmap (Sectors)
- Mindmap (Sub-Sectors)
- Mindmap (Regions)

AI in Pharma Industry Landscape

View More

Dashboard Parameters

COMPANIES	INVESTORS	R&D DEALS
286	733	117
FUNDING ROUNDS	**PARAMETERS**	**DATA POINTS**
592	4192	43000+

Industry Growth Dynamics

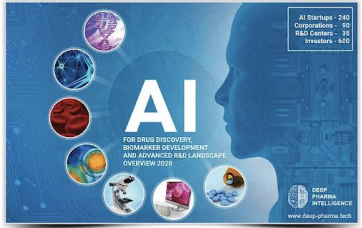
View More

- Investment Digest
- Funding Rounds
- Deals

Industry Developments

- Matching Tool
- Downloadable Materials
- FAQ

Industry Report 2020

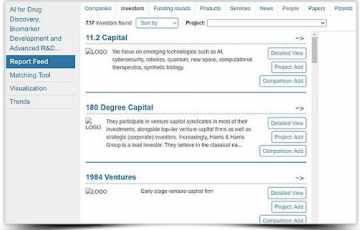


View More

Proprietary Analytics

View More

Industry Database



View More

AI in Drug Discovery

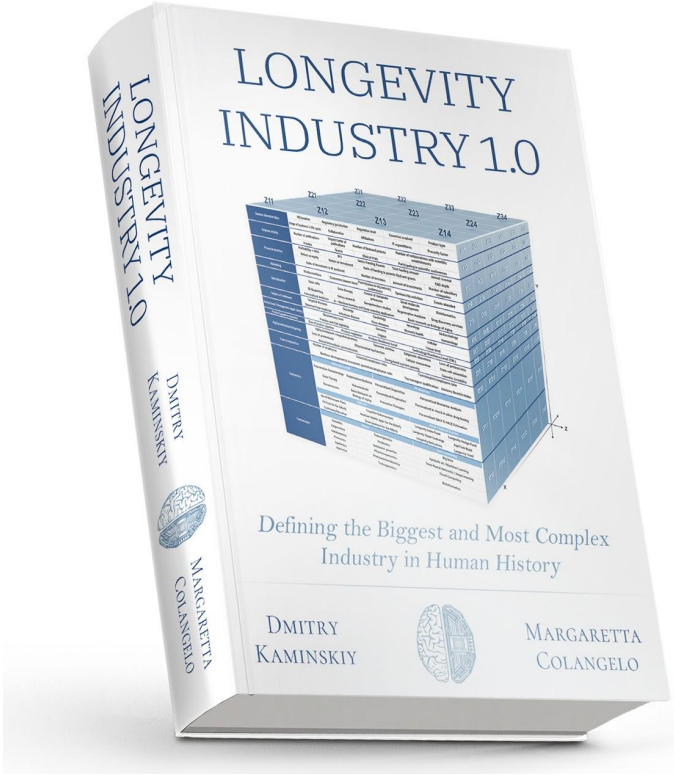
- Business Trends
- Investment Trends
- Technology Trends
- Current Challenges

You Are Welcome! 👋

Longevity Investment: Big Data Analytics Dashboard

Total amount of capital monitored: $156B

www.longevity-book.com



Longevity Industry 1.0
Defining the Biggest and Most Complex Industry in Human History

PART I. Longevity Industry Mega-Complexity

PART II. Longevity Policy and Governance

PART III: The Longevity Financial Industry

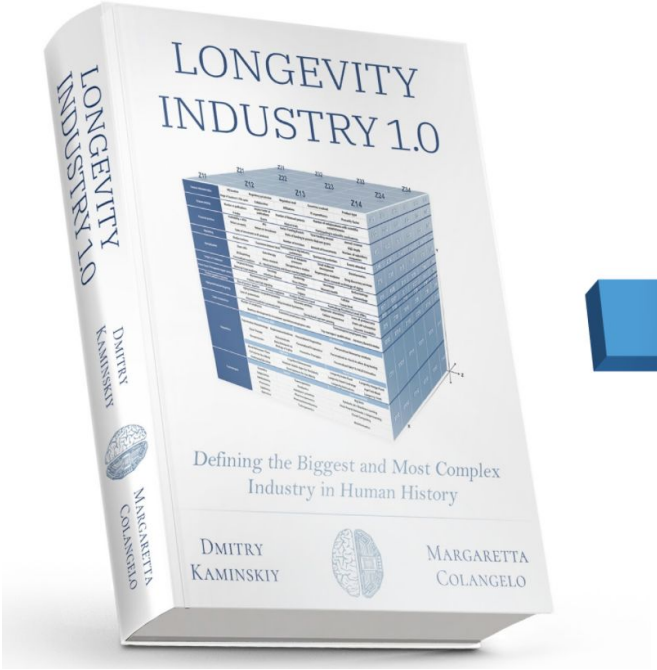
Novel Longevity Derivatives and Health as New Wealth

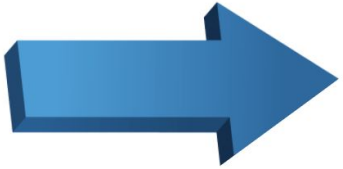
- **The Increasing Role of Longevity in Global Finance**
- Longevity Embraced by the World's Biggest Financial Corporations: Investment Banks, Insurance Companies, Asset Management Firms
- Longevity Derivatives: New Business Models and Novel Financial Instruments Tied to the Rising Longevity Industry
- AgeTech, WealthTech, FinTech
- Why Traditional BioTech Analytics Fails Against the Longevity Industry's Extreme Complexity

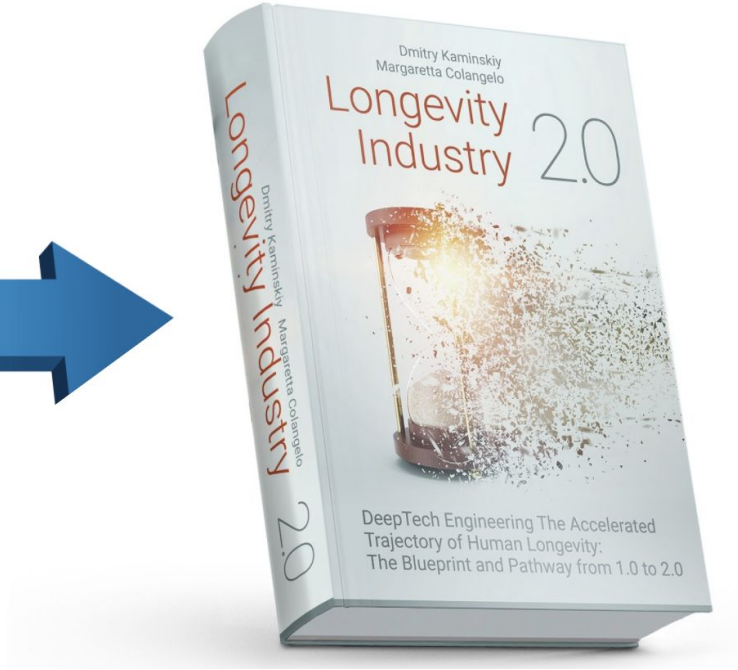
PART IV. Longevity Industry (Science and Biomedicine)

Global Industrialization of Longevity

www.longevity-book.com







Longevity Industry 1.0
Defining the Biggest and Most Complex Industry in Human History

Longevity Industry 2.0
DeepTech Engineering The Accelerated Trajectory of Human Longevity
The Blueprint and Pathway from 1.0 to 2.0

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