Realizing the Healthy Longevity Dividend: A Global Grand Challenge

Victor J. Dzau, MD
President, National Academy of Medicine

February 28, 2018
U.S. National Academy of Sciences (1863)

“The Academy shall, whenever called upon by any department of the government, investigate, examine… and report upon any subject of science or art…”

The Institute of Medicine (IOM) was founded in 1970 and reconstituted as the National Academy of Medicine in 2015.

The New York Times describes the IOM as “the most esteemed and authoritative adviser on issues of health and medicine, and its reports can transform medical thinking around the world.”
Post-July 1, 2015 Structure: The National Academies of Sciences, Engineering and Medicine

The National Academies of Sciences, Engineering and Medicine

Programs of the Academies

- Division of Behavioral & Social Sciences & Education
- Division on Earth & Life Sciences
- Division on Engineering & Physical Sciences
- Gulf Research Program
- Health & Medicine Division
- Policy & Global Affairs
- Transportation Research Board
Members: A Network of Excellence

- Up to 70 regular members and 10 international members elected yearly
- Over 2000 members
- More than 500 members come from outside of the health professions
- 50 Nobel laureates
- 58 National Medal of Science honorees
- 21 National Medal of Technology and Innovation honorees,
- Multiple Lasker award winners, countless others who have received recognition
Setting the Agenda in Medicine and Health

Convening the best minds in health & science

2015 Global Summit on Human Gene Editing co-hosted with the NAS, Royal Society and Chinese Academy of Sciences

High-quality and high-impact reports and recommendations to inform future direction health and medicine
Authoritative Reports

Examples of Impact & Influence

1999 -
PATIENT SAFETY

1986
AIDS RESEARCH AND CARE

1988
HUMAN GENOME PROJECT

2011
PRECISION MEDICINE

2017
HUMAN GENE EDITING

2016
GLOBAL INFECTIOUS DISEASE RISK

1997 -
US DIETARY GUIDELINE
NAM Priorities

1. Respond to critical and pressing issues
2. Advise the nation and the world on the future of health and health care
3. Lead and inspire for the future
NAM Initiatives

The Neglected Dimension of Global Security
A Framework to Counter Infectious Disease Crises

Healthy Longevity
Grand Challenge

National Academy of Medicine
Action Collaborative on Clinician Well-Being and Resilience

Vital Directions
for Health and Health Care

Communities in Action
Pathways to Health Equity

Culture of Health
Life expectancy, 1916
Shown is period life expectancy at birth. This corresponds to an estimate of the average number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

Source: Clio-Infra estimates until 1949; UN Population Division from 1950 to 2015
OurWorldInData.org/life-expectancy-how-is-it-calculated-and-how-should-it-be-interpreted/ • CC BY-SA
Life expectancy, 2015

Shown is period life expectancy at birth. This corresponds to an estimate of the average number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

Source: Clio-Infra estimates until 1949; UN Population Division from 1950 to 2015
OurWorldInData.org/life-expectancy-how-is-it-calculated-and-how-should-it-be-interpreted/ • CC BY-SA
What is the urgency around global aging?

Today, 9% of global population (617M people) is 65+

In 2050, ~20% of global population (1.6 B people) will be 65+

Source: United Nations Department of Economic and Social Affairs
Number of people aged 60 or over:
World, developed and developing countries, 1950-2050

Since the 1960s, total global fertility rates have been cut in half.
Hong Kong Demographic Changes

- Median age increased from 39.6 in 2006 to 43.4 in 2016.
- Life expectancy in 2016 is 84 years.
- The proportion aged 65 or older increased from 12 % of the population in 2006 to a new high of 16 % (2016).
  - In 1986 the figure was just 8 %.
- Proportion under-14 shrunk from 14 % in 2006 to 11 % in 2016.
## Hong Kong Demographic Changes

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Projected</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1991</td>
<td>2001</td>
</tr>
<tr>
<td>The proportion of the population aged 65+</td>
<td>9%</td>
<td>11%</td>
</tr>
<tr>
<td>The proportion of the population aged &lt;15</td>
<td>21%</td>
<td>17%</td>
</tr>
<tr>
<td>The median age of the population</td>
<td>31.5</td>
<td>36.7</td>
</tr>
</tbody>
</table>
So, where do these trends lead us....?
The “Silver Tsunami”

In both industrialized and developing countries, the rate of population aging stands to fundamentally impact how families, communities, societies, industries and economies function

- Infirmitities: patterns and prevalence
- Health care delivery and financing
- Family structure and relationships
- Social infrastructure
- Social insurance and retirement programs
- Workforce size and composition
Age-related Diseases and Conditions in US and HK

10 Common Chronic Conditions for Adults 65+

Quick Facts:
- 80% have at least 1 chronic condition
- 68% have 2 or more chronic conditions

- Hypertension (High Blood Pressure) 58%
- High Cholesterol 47%
- Arthritis 31%
- Ischemic Heart Disease (or Coronary Heart Disease) 29%
- Diabetes 27%
- Chronic Kidney Disease 18%
- Heart Failure 14%
- Depression 14%
- Alzheimer’s Disease and Dementia 11%
- Chronic Obstructive Pulmonary Disease 11%

Source: National Council on Aging

Source: Census and Statistics Department (2013); Our Hong Kong Foundation
Burden of Dementia and Alzheimer’s Disease

• 5.2% of people 60+ and 30% of people 85+ are living with dementia globally

• Alzheimer’s disease is the most prevalent form of dementia

• 2015 estimated worldwide cost of dementia was $818 billion (USD) and projected to pass $1 trillion in 2018

• 1 new case of dementia every 3 seconds (worldwide)

• Number of people living with dementia expected to double every 20 years
Family Structures are Changing

- Increasing life expectancy means several generations are living simultaneously
- Fewer children or childlessness
- Rising rates of divorce & single parenting
- Multigenerational households are decreasing, as elderly are less likely to live with their children
- Overall, less familial care support available
- Social isolation

“Beanpole” Family Structure: A vertical extension of family structure characterized by more but smaller generations (WHO, 2011)
Living Arrangements of People Aged 65 and Over in Japan: 1960 to 2005

Percentage Aged 65+ Living:
- In institutions
- Alone
- With spouse only
- With child(ren)

1960: 87% in institutions, 7% alone, 4% with spouse only, 1% with child(ren)
1980: 70% in institutions, 18% with spouse only, 8% with child(ren)
1995: 56% in institutions, 28% with spouse only, 12% with child(ren)
2005: 47% in institutions, 33% with spouse only, 15% with child(ren)

Note: Percentages living with child(ren) include small numbers of people living in unspecified arrangements.
Shrinking Ratios of Workers to Pensioners

The ratio of workers to pensioners will decrease

2013: 4 workers / 1 pensioner
2060: 2 workers / 1 pensioner

-50%

Source: European Commission, Ageing Report 2015

Old-age dependency ratios
Number of people aged 65 and over
As % of labour force (aged 15-64), forecasts

Source: European Commission
Figure 13:
CHINA'S DECLINING RATIO OF COVERED WORKERS TO PENSIONERS

In the U.S.: Most families—even those approaching retirement—have little or no retirement savings

Median retirement account savings of families by age, 1989–2013 (2013 dollars)

Note: Scale changed for visibility. Retirement account savings include 401(k)s, IRAs, and Keogh plans.

$400 Trillion Shortfall in Retirement Savings

Swelling Shortfall in Savings
The retirement gap in U.S. and China could top $100 trillion each by 2050

Source: World Economic Forum Report
• In the U.S., nearly half of working-age families have nothing saved in retirement accounts, and the median working-age family had only $5,000 saved in 2013.

• Meanwhile, the 90th percentile family had $274,000, and the top 1 percent of families had $1,080,000 or more (not shown on chart).

• Huge disparities reflect a growing gap between haves and have-nots since the Great Recession.

The gap between the retirement ‘haves’ and ‘have-nots’ has grown since the recession


Note: Retirement account savings include 401(k)s, IRAs, and Keogh plans. Scale changed to accommodate larger values.

Are we prepared? **Global Aging Preparedness Index**

**GAP Index Country Rankings and Change from First Edition Rankings**

<table>
<thead>
<tr>
<th>Fiscal Sustainability Index</th>
<th>Country Ranking</th>
<th>Change</th>
<th>Income Adequacy Index</th>
<th>Country Ranking</th>
<th>Change</th>
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<td>20 Spain</td>
<td>—</td>
<td>20 Poland</td>
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</table>

*Note: Countries are ranked from best to worst.*

**Global AgeWatch Index 2015**

<table>
<thead>
<tr>
<th></th>
<th>Overall rank and value</th>
<th>Income security</th>
<th>Health status</th>
<th>Capability</th>
<th>Enabling environment</th>
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<tbody>
<tr>
<td>Rank</td>
<td>Value</td>
<td>Rank</td>
<td>Value</td>
<td>Rank</td>
<td>Value</td>
</tr>
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<td>1</td>
<td>90.1</td>
<td>27</td>
<td>77.3</td>
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<tr>
<td>Norway</td>
<td>2</td>
<td>89.3</td>
<td>2</td>
<td>89.4</td>
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<tr>
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<td>82.9</td>
<td>4</td>
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<td>Netherlands</td>
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<td>Iceland</td>
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<td>29</td>
<td>76.3</td>
<td>25</td>
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<tr>
<td>United Kingdom</td>
<td>10</td>
<td>79.2</td>
<td>14</td>
<td>81.5</td>
<td>27</td>
</tr>
</tbody>
</table>
Some Findings

CSIS, 2013

• Very few countries have made significant additional progress in reducing the projected magnitude of their old-age dependency burdens

• Many countries that do well on one dimension of “aging preparedness” do poorly on the other…There are also few countries that fail to score well on either dimension of aging preparedness

HelpAge International, 2015

• Countries perform best when they take a comprehensive approach by investing in pensions, access to healthcare and supporting the social inclusion of older people
Aging and Healthy Longevity: A Global Grand Challenge

• Overall, very mixed levels of preparedness globally
• While some countries and governments have begun to act and are starting plan for the long-term, too many have not
• *Preparing financially, socially, and scientifically for longer lifespans is a global imperative*
How do we effectively prepare and better equip ourselves for aging and healthy longevity globally?
Daily Living Challenges and Personal Well-being

- Activities of daily living
- Safety, security, and mobility
- Social connectedness, isolation and loneliness
- Sense of purpose, and ability to contribute in a meaningful way to society
Complexity of clinical medicine and health care delivery systems for the elderly

- **Age-related disease**
  - Shift in disease epidemiology
    - Rates of chronic disease > infectious & parasitic diseases
  - Increasing rates of Dementia and Alzheimer’s disease
  - Also: delerium, frailty, degenerative join disease, hearing loss, depression and anxiety

- **Health care delivery**
  - Acute and emergency care
  - Post-acute and rehabilitative care
  - Preventive care
  - Long-term care
  - Palliative care
  - Eldercare workforce

- **Health care financing and insurance**

- **Social services integration**
Long-term Care

• Long-term care (LTC) involves a variety of services designed to meet a person's health or personal care needs during a period of time. These services help people live as independently and safely as possible when they can no longer perform everyday activities on their own.

• Most common type of LTC is personal care (specifically, help with “activities of daily living”).

• LTC can include home nursing, community care and assisted living, residential care, and long-stay hospitals.

• In the U.S., most LTC is provided in the home by unpaid family members or friends. Medicare does not cover LTC; Medicaid provides long-term services and supports for low-income Americans.
<table>
<thead>
<tr>
<th>Country</th>
<th>Public Spending on LTC as a Percentage of GDP</th>
<th>Financial Protection for LTC Recipients</th>
<th>Informal Care Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td></td>
<td></td>
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<td>Germany</td>
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<td>U.S.</td>
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<td>China</td>
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<td>Brazil</td>
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<tr>
<td>Turkey</td>
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</table>

Sources: OECD; FP Analytics
Importance of health and social care services integration

• U.S. far outspends its peer nations on health care and spends considerably less on social care services
• Poverty, food insecurity, unstable housing, social isolation, and mental health problems contribute to higher rates of chronic illness, poorer health and outcomes, higher utilization of the health care system, and greater costs
Globally, comparable total health and social services expenditures – but different mix

In OECD, for every $1 spent on health care, about $2 is spent on social services
In the US, for $1 spent on health care, about 55 cents is spent on social services
Policy and financing — What are governments globally contending with?

• **Societal implications**
  • Rising stress burden on individuals and families
  • Financial security and debt
  • Health, happiness and well-being

• **Economic implications**
  • Rising health care costs
    • Elderly are high-need, high-cost patients
  • Sustainability of social insurance and benefit systems
    • Rising social insurance and benefit expenditures
  • Patterns of work and retirement
    • Shrinking ratios of workers to pensioners
    • Official vs. actual age of retirement
Figure 11:  
PUBLIC PENSION INCENTIVES TO LEAVE THE LABOR FORCE FOR MEN IN 11 COUNTRIES  
Percent of men age 55 to 65 not working  

**Opportunities for Innovation and Progress**

**Build robust community social infrastructure**

<table>
<thead>
<tr>
<th>Elements</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessibility</strong></td>
<td>Ensure safety, security, and mobility</td>
</tr>
<tr>
<td>• Access to transportation services and related barrier-free facilities</td>
<td>Elevate convenience and comfort of living</td>
</tr>
<tr>
<td>• Elder-friendly facilities in houses and public accommodations</td>
<td>Prevent isolation and loneliness</td>
</tr>
<tr>
<td><strong>Engagement</strong></td>
<td>Promote social participation</td>
</tr>
<tr>
<td>• Community facilities/events for recreation, culture, or socialization</td>
<td>Facilitate economic contribution</td>
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<tr>
<td>• Networks/programs for volunteering or intergenerational interaction</td>
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<tr>
<td><strong>Assistance</strong></td>
<td></td>
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<tr>
<td>• Regular phone-call/home-visit check-ins, or emergency hotlines</td>
<td></td>
</tr>
<tr>
<td>• Community-based services, e.g., meal, hygiene, and health consultation</td>
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</tr>
</tbody>
</table>

Source: AARP, 2017
Opportunities for Innovation and Progress

Reform health systems and models of care delivery

Reform health systems and approaches to care
• Place greater emphasis on life course approaches, disease prevention, health promotion, and early screening
• Train clinicians to better address multiple, interrelated health conditions
• Better integrate health and social services, including home and community services

Address health care delivery gaps
• Build a robust geriatric workforce
• Design and test new models of long-term care (that are home and community-based)
• Provide greater support for caregivers (skills development, links to resources and information, respite services)
Opportunities for Innovation and Progress  
*Driving systemic change through policy and financing*

Promoting the health, security, and engagement of older populations requires:

- A strong social safety net
- Investment in social infrastructure and healthy environments
- Pension reform and sustainable entitlement programs
- Inclusive and innovative business and employment practices
Harness science and technology to drive transformative breakthroughs

Ongoing research & development across:

• Age-related disease
• Biology of aging
• Disruptive technologies
Realizing the Healthy Longevity Dividend

• Mitigating the challenges and potential burdens posed by global aging will require broad, systematic change and deliberative action across
  • Basic and translational science
  • Clinical medicine and health care
  • Personal, social, economic, and environmental determinants
  • Policy and financing
• There is a need for a comprehensive and global assessment of the challenges facing the aging population, including the promising solutions and directions required for improving health, productivity, and quality of life
Awards and Prizes

• Catalyze breakthrough ideas that will expand the healthspan into later life. Convergence of biologic, social, engineering sciences and technologies.

• Achieve transformative and scalable innovation in healthy aging and longevity.

• Build a broad ecosystem of support.

Global Roadmap for Healthy Longevity

Comprehensive assessment of the challenges and opportunities presented by global aging, as well as the promising solutions and necessary directions for improving, health, productivity, and quality of life.
Global Roadmap for Healthy Longevity

• Part of the NAM’s Healthy Longevity Grand Challenge initiative, the Global Roadmap will produce a comprehensive report assessing the challenges presented by global aging and demonstrating how these challenges can be translated into opportunities for societies globally through levers across policy, practice, and socioeconomic infrastructure.

• The report will be informed by 4 concurrent workstreams:
  • Science, technology, and innovation
  • Clinical medicine, health care delivery systems, and health promotion
  • Personal, social, economic, and environmental enablers
  • Policy and financing

• The activity will bring together thought leaders across science, medicine, healthcare systems, engineering, technology, and policy.
Global Roadmap Planning Group Members

Sarah Barber, WHO Kobe Centre
Michael Birt, Blue Triangle Health*
Laura Carstensen, Stanford University
Christine Cassel, Kaiser Permanente School of Medicine
Sally Davies, Chief Medical Officer for England
Deborah DiSanzo, IBM Watson Health
Victor Dzau, National Academy of Medicine*
Linda Fried, Columbia University
Jeffrey Halter, University of Michigan and National University of Singapore
Richard Hodes, National Institute on Aging
Sharon Inouye, Harvard Medical School*
Paul Irving, Milken Institute Center for the Future of Aging
Joseph Kvedar, Partners Healthcare
Keith Leonard, Unity
Hiroki Nakatani, Keio University
Jack Rowe, Columbia University
Lewis Sandy, UnitedHealth Group
Kamili Wilson, AARP
John Wong, National University Health System, Singapore
Tachi Yamada, Frazier Healthcare Partners*
Charlotte Yeh, AARP Services, Inc.

* Member of Steering Committee
Extending the Healthspan: Opportunities in Science and Technology

• By delaying the biological processes associated with aging, we could prevent debilitating illness and disease, and loss of function
  • Several areas of promising research that have demonstrated that biological aging is, in fact, modifiable—and that, in some cases, health and/or lifespan can be extended
  • Using technology to transform the way we age
    • Technology can help ease the activities of daily living and improve the quality and accessibility of healthcare for the elderly
Biology of Aging Research

Research to extend the healthspan and inform cures:

- Caloric restriction
- Molecular pathways (mTOR, metformin and acarbose, NAD precursors and sirtuin activators)
- Cellular regeneration, genes, and epigenetics
- Senescent cells and telomere dysfunction
- Mitochondrial DNA damage and dysfunction
- Longevity genes
- Epigenome / epigenetic clock
Disruptive Technologies

In use:
• Emergency response pendants
• Smart pill boxes
• GPS tracking devices
• Retractable tripods
• Telehealth
• Remote patient monitoring

Emerging:
• Robot care givers and companions
• Wearable robotic systems and exoskeletons
• Smart homes
• Autonomous vehicles
• Virtual reality
• Artificial intelligence
Intelligent Assistants: Nora

- Makes every day/routine tasks easier - Pay bills, find a doctor nearby, refill prescription, monitor health in real time and notify family members or medical personnel if desired
- Manages chronic diseases - Monitor blood sugar, track calorie intake and activity, order supplies
- Provides care anywhere - Understand care plans, care delivery at home, integrate with IoT
- Improves health IQ - Proactively engages with user to achieve health goals
- Plays the role of information agent - Provide a personalized package of insights, advice, and data based on individual cases/circumstances
NAM Healthy Longevity Prizes and Awards

• Catalyze breakthrough ideas and research that will expand the healthspan into later life. Support promising, cross-disciplinary ideas and research exploring potentially breakthrough solutions for healthy aging and longevity.

• Achieve transformative and scalable innovation in healthy aging and longevity by translating evidence into action. Translate groundbreaking research to create transformative and scalable innovations that will advance healthy longevity in an equitable way around the world.

• Build a broad ecosystem of support. Globally, engage new minds to enter the field and work together to achieve the promise of healthy aging and longevity, including scientists, engineers, innovators, entrepreneurs, health leaders, policy makers, and the public.
Design Framework

Phase 1: Funding to explore new, innovative ideas

Phase 2: Funding to advance a pilot or prototype

Phase 3: Rewarding the achievement of a bold and transformative innovation
Prize Program Design Committee

Tachi Yamada, M.D. (Chair)
Frazier Healthcare Partners

Nancy E. Adler, Ph.D.
University of California, San Francisco

Mark C. Fishman, M.D.
Harvard University

Diane E. Griffin, M.D., Ph.D.
Johns Hopkins University

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A Vision for Healthy Longevity

Source: Adapted from World Health Organization (2015)

Thank you

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Technologies of the Future

- Robot assistants and companions
- Wearable robotic systems and exoskeletons
- Virtual reality
- Artificial intelligence
The Speed of Population Aging

The number of years for population age 65+ to increase from 7% to 14%

<table>
<thead>
<tr>
<th>Developed Countries</th>
<th>Years</th>
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</thead>
<tbody>
<tr>
<td>France (1865-1980)</td>
<td>115</td>
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<tr>
<td>Sweden (1890-1975)</td>
<td>85</td>
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<tr>
<td>Australia (1938-2011)</td>
<td>73</td>
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<tr>
<td>US (1944-2013)</td>
<td>69</td>
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<tr>
<td>Canada (1944-2009)</td>
<td>65</td>
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<td>Hungary (1941-1994)</td>
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<td>Poland (1966-2013)</td>
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<td>UK (1930-1975)</td>
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<tr>
<td>Spain (1947-1992)</td>
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<tr>
<td>Japan (1970-1996)</td>
<td>26</td>
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</tbody>
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<thead>
<tr>
<th>Developing Countries</th>
<th>Years</th>
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</thead>
<tbody>
<tr>
<td>Azerbaijan (2000-2041)</td>
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<td>Chile (1998-2025)</td>
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<td>China (2000-2026)</td>
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<td>Jamaica (2008-2033)</td>
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<td>Tunisia (2008-2032)</td>
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<td>Sri Lanka (2004-2027)</td>
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<td>Thailand (2003-2025)</td>
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<td>Brazil (2011-2032)</td>
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<tr>
<td>Colombia (2017-2037)</td>
<td>20</td>
</tr>
<tr>
<td>Singapore (2000-2019)</td>
<td>19</td>
</tr>
</tbody>
</table>

Source: Kinsella et al., 2007
82% of Americans age 65 and older receive Social Security.

61% of seniors receive interest or other asset income, but amounts are too small to matter much.

Earned income is a major source of income, but only for the 22% of seniors with earnings.

Public and private pensions are a much more important source of income than distributions from retirement accounts.
Growing Burden of Chronic Disease

While people are living longer, they are not necessarily healthier.

Shift in disease epidemiology where rates of chronic disease > infectious & parasitic diseases

NCDs kill 40M people each year, equivalent to 70% of all deaths globally (WHO, 2017)

By 2030, NCDs estimated to cost $47T (WEF, 2011)
Median total debt in 2013 USD for households with any debt headed by someone 60 or older, 1989-2013

Source: Federal Reserve Bank, Survey of Consumer Finances

Source: National Council on Aging
Opportunities for Innovation and Progress

*Driving systemic change through policy and practice*

Promoting the health, security, and engagement of older populations requires:

- **A strong social safety net**
  - Better align health and social care spending and resources
- **Investment in social infrastructure and healthy environments**
  - Support opportunities for healthy aging in place
  - E.g. Singapore’s City For All Ages Project
- **Pension reform and sustainable entitlement programs**
  - Remove mandatory retirement practices, and reevaluate age of retirement
- **Inclusive and innovative business and employment practices**
  - Mitigate workplace discrimination through anti-ageism legislation and enforcement
  - Support older adults’ employability and incentivize businesses to employ older workers
  - Incentivize companies to participate in the age-related technology market
  - E.g. Chinese central government has offered a range of incentives including subsidies and preferential taxes
Survey of 72 NCOA aging network professionals revealed frequent encounters with clients with “significant or unmanageable” medical, credit card, mortgage, and utility debt or missed payments.
In the US, long term services and supports are expensive, often exceeding what beneficiaries and their families can afford.

Figure 2

Long-Term Services and Supports Are Expensive, Often Exceeding What Beneficiaries and Their Families Can Afford

Median Annual Care Costs, by Type of Service, 2015

- Nursing Facility: $91,250
- Home Health Aide: $45,760
- Adult Day Health Care: $17,940

100% FPL for a family/household of three, 2015