



Better with age: the silver opportunity

As human life expectancy steadily increases, governments are faced with the responsibility of providing health and social care to a population that has a greater proportion of elderly people than ever before. This presents new opportunities for parties including governments, health care providers and pharmaceutical companies to innovate and collaborate – and there is significant potential to improve the quality of life for elderly people, and drive cost-efficiency for governments and reimbursement for providers.



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Across the world, life expectancy is steadily increasing. Currently Japan has the highest life expectancy, with people born today expected to reach 83.7 years,¹ closely followed by Switzerland, Singapore and Australia. This presents governments with an array of challenges to minimize the burden of aging on social and health care systems.

A decrease in birth rates in many developed countries² and the rise in life expectancy will further increase the percentage of people aged over 65 living in our societies. For example, in 2014, people aged over 65 made up 26% of Japan's population, a number expected to rise to 31.6% in 2030 and 39.9% in 2060.³

Health care budgets around the world are under enormous pressure and an aging society is one of the main drivers of rising costs. This pressure has resulted in cost containment initiatives by governments, targeting all business stakeholders, including the pharmaceutical industry.

Governments are giving particular attention to the cost of chronic diseases such as dementia, cancer and diabetes, as well as cardio, respiratory and cerebrovascular pathologies. These morbidities or co-morbidities require frequent prescriptions, regular interaction with medical staff and, in many cases, hospitalization and care center support, often resulting in palliative care.

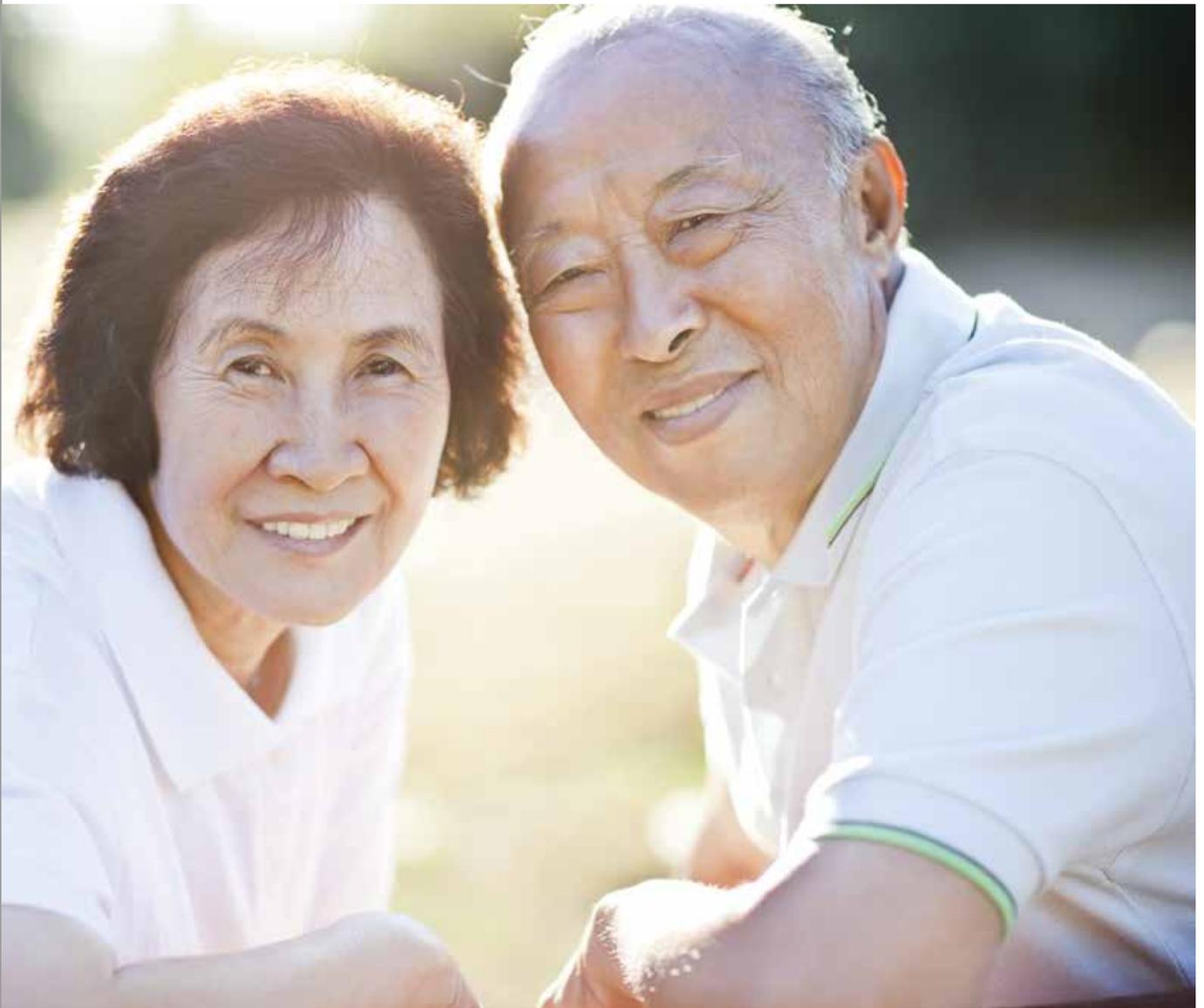
Over the last 50 years, vast improvements have been made in extending life expectancy, but now the ability to decrease the number of years individuals live with disease has become of prime importance.

Japanese men, for example, in the last approximately nine years of their lives, live with at least one disease, and for women, this is true for around the last 12 years of their lives. These numbers have not changed considerably over the last decade. Achieving even a small decrease of 6 to 10 months across the population would have a profound impact on social and health care budgets.



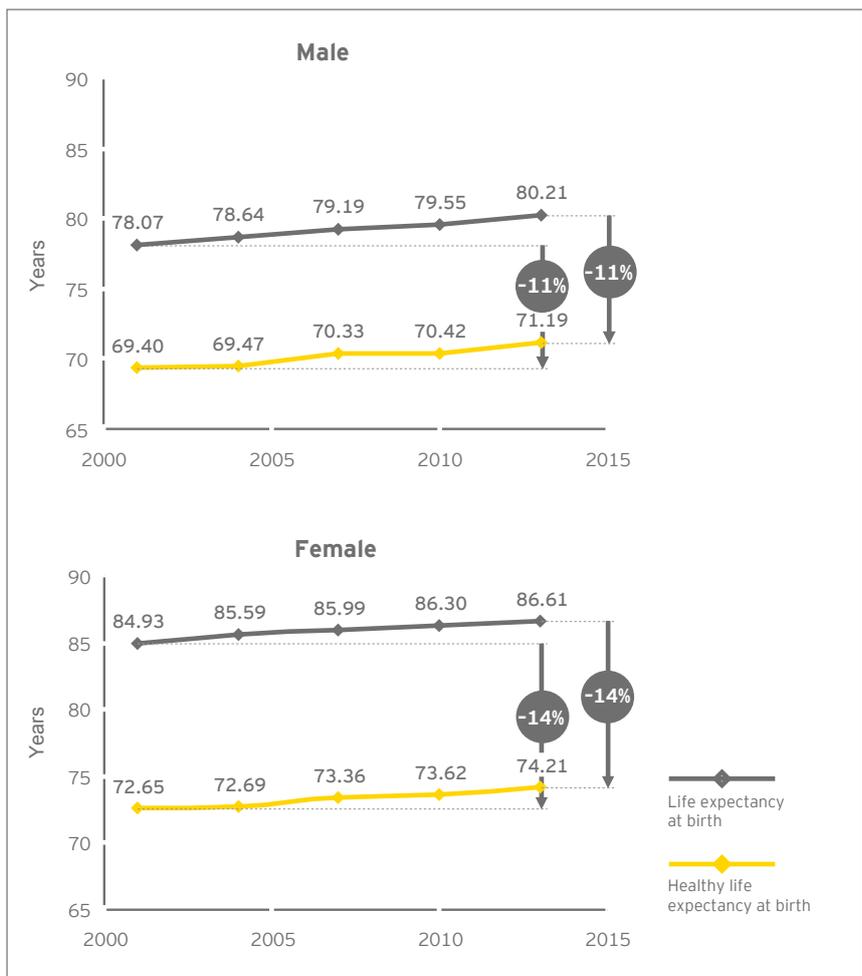
1. World Health Organization.
2. For example, in Japan, the average annual number of births per year per 1,000 people is 8, World Bank.
3. <http://data.worldbank.org>.

Health care budgets around the world are under enormous pressure and an aging society is one of the main drivers of rising costs.



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Figure 1. Life expectancy at birth compared with healthy life expectancy at birth (Japan, 2001 to 2013)



Source: For life expectancy at birth: "Abridged life table," Ministry of Health, Labour and Welfare, Japan (MHLW), for 2001, 2004, 2007 and 2013; "Complete life table," MHLW, for 2010.
 For healthy life expectancy at birth: "Projection of the healthy life expectancy and the study on the cost-effectiveness of the measures against lifestyle diseases," Health and Labour Sciences Research Grant, for 2001, 2004, 2007 and 2010; estimates derived from "Comprehensive survey of Living Conditions," MHLW, for 2013.

Potential opportunities for pharmaceutical companies to innovate and partner

We see the aging society as an opportunity for the pharmaceutical industry. There are particular areas where innovative new products might have a lasting impact, while helping to reduce the cost burden:

1. **Innovation targeting aging and age-related diseases on a molecular level**
 - ▶ Therapeutic area-specific molecular innovation
 - ▶ Preventive solutions
 - ▶ Aging biology innovation
2. **Innovation targeting aging and age-related diseases with added services**
 - ▶ Feedback loops
 - ▶ Other innovative approaches
3. **Exploring new territories**
 - ▶ Case example: Homecare

To capture these business opportunities, pharmaceutical companies will need to recognize which innovations and new products are likely to have the biggest impact on reducing the burden of the aging society, but also how they will be reimbursed for their efforts.



1. Innovation targeting aging and age-related diseases on a molecular level

Continued R&D efforts to discover novel molecular treatments for age-related pathologies, such as Alzheimer’s, cancer, chronic obstructive pulmonary disease, cardiovascular and cerebrovascular pathologies, as well as diabetes, will be the industry’s backbone and key to scientific, clinical and business success. Beyond traditional R&D approaches, further dedicated efforts in disease prevention and regenerative medicine, which includes gene therapy and tissue engineering, show great promise.

► **Therapeutic area-specific molecular innovation**

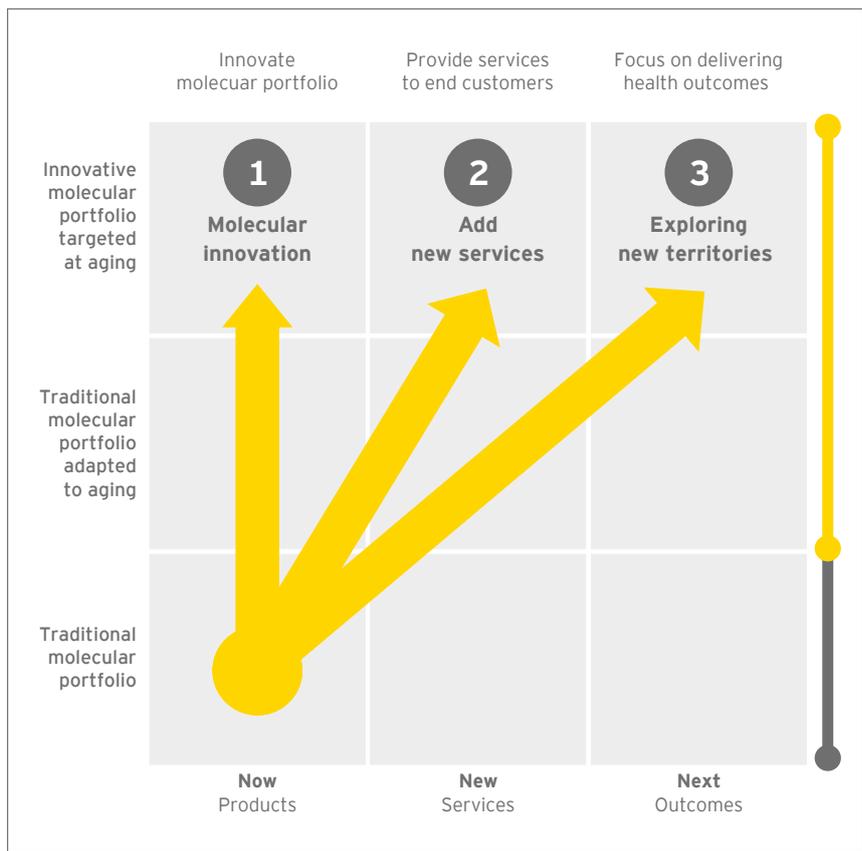
Roche has been active in recruiting participants of 70 years of age and over for selected geriatric clinical trials, such as the Avastin™ trial aimed at treating ovarian cancer.⁴ In addition, Roche’s Venetoclax™, Mabthera™ and Tarceva™ have all been tested specifically in individuals above the age of 60. Alzheimer’s disease is another area of great interest. Takeda and Zinfandel Pharmaceuticals recently completed recruitment for their TOMMORROW Ph3 trial. This trial is an excellent example highlighting how therapies aimed at one chronic morbidity (diabetes) can be “repurposed” to address yet another chronic disease, Alzheimer’s.⁵

Over the last 50 years, vast improvements have been made in extending life expectancy, but now the ability to decrease the number of years that individuals live with disease has become of prime importance.

4. <https://clinicaltrials.gov>, search under reference number NCT02393898.
 5. “Takeda and Zinfandel Pharmaceuticals Complete Enrollment in TOMMORROW Trial,” takeda.com, https://www.takeda.com/news/2016/20160210_7298.html, accessed 17 February 2017.

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Figure 2. Clustering of new business opportunities and models



► **Preventative solutions**

Johnson & Johnson (J&J) has created the Janssen Prevention Center⁶ to identify markers that direct J&J's search for preventive solutions, such as vaccines, oral drugs and interventions influencing the human microbiome. Measuring, maintaining and extending healthy lives is the aim of J&J's visionary program. DO-HEALTH,⁷ a clinical trial on prevention, sponsored by the University of Zurich (with support from the pharmaceutical and nutrition industry) aims to establish whether vitamin D, omega-3 fatty acids and home exercise prevent disease at an older age.

Further, Takeda⁸ and Daiichi-Sankyo,⁹ together with the Chemo-Sero Therapeutic Research Institute have initiated an expanded distribution network of seasonal flu shots for elderly people.

► **Aging biology innovation**

In the regenerative medicine area, Astellas recently formed a research unit¹⁰ with the goal of delivering cell therapy and transplant innovations aimed at recovering and restoring lost organ and tissue function due to aging, among other factors. Astellas also sees its research in urology as crucial, given that treatments for overactive bladders will be in increased demand.

There are particular areas where innovative new products might have a lasting impact, while helping to reduce the cost burden.

Novartis, a leading innovator in the field of aging, boasts a range of programs focusing on the biology of aging. Examples include its Afinitor™ anti-aging work and its progress toward addressing geriatric medical challenges, such as hearing and vision loss. Additionally, Novartis researches osteoporosis as well as muscle wasting – both key factors in the loss of independence among elderly patients.

In the US, Calico also focuses strongly on research into the biology of aging. Partnering is key to Calico's strategy: for example, Calico's collaboration with QB3¹¹ recently made headlines when studies highlighted that adjusting certain protein levels in mice allowed them to live significantly longer.

Ascentage Pharma and Unity Biotechnology have teamed up to develop new and innovative senolytic drugs.¹² Further, Daiichi-Sankyo recently established a dedicated research unit named Venture Science Laboratories, focusing and collaborating on research targets related to aging.



6. <http://www.janssen.com/janssen-prevention-center>, accessed 17 February 2017.
7. <http://do-health.eu/wordpress/>, accessed 17 February 2017.
8. "Takeda Announces Seasonal Influenza Vaccine Sales Agreement with Kaketsuken in Japan," [takeda.com](https://www.takeda.com/news/2015/20150519_6993.html), https://www.takeda.com/news/2015/20150519_6993.html, accessed 17 February 2017.
9. "Daiichi Sankyo Announces Cooperative Sales Agreement for the Influenza HA Vaccine 'Kaketsuken'," [daiichisankyo.com](http://www.daiichisankyo.com/media_investors/media_relations/press_releases/detail/006296.html), http://www.daiichisankyo.com/media_investors/media_relations/press_releases/detail/006296.html, accessed 17 February 2017.
10. "Astellas: Establishment of Regenerative Medicine Unit," [astellas.com](https://www.astellas.com/en/corporate/news/detail/astellas-establishment-of-rege.html), <https://www.astellas.com/en/corporate/news/detail/astellas-establishment-of-rege.html>, accessed 17 February 2017.
11. "Calico and QB3 announce partnership to conduct research into the biology of aging and to identify potential therapeutics for age-related diseases," [calicolabs.com](https://www.calicolabs.com/news/2015/03/24/), <https://www.calicolabs.com/news/2015/03/24/>, accessed 17 February 2017.
12. "Ascentage Pharma and UNITY Biotechnology Announce Collaboration for the Development of Senolytic Healthspan Therapies," [prnewswire.com](http://www.prnewswire.com/news-releases/ascentage-pharma-and-unity-biotechnology-announce-collaboration-for-the-development-of-senolytic-healthspan-therapies-300256473.html), <http://www.prnewswire.com/news-releases/ascentage-pharma-and-unity-biotechnology-announce-collaboration-for-the-development-of-senolytic-healthspan-therapies-300256473.html>, accessed 17 February 2017.

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2. Innovation targeting aging and age-related diseases with added services

While continued advances in molecular therapies are of paramount importance, recent examples of inventive strategies have opened up alternative pathways to innovation. In many cases these paths include, or are based on creating, feedback loops through data collection and analysis, which is arguably the single most critical requirement for health outcomes monitoring and reimbursement in the decades to come. Other innovative approaches include gamification, bioelectronics or artificial intelligence (AI).

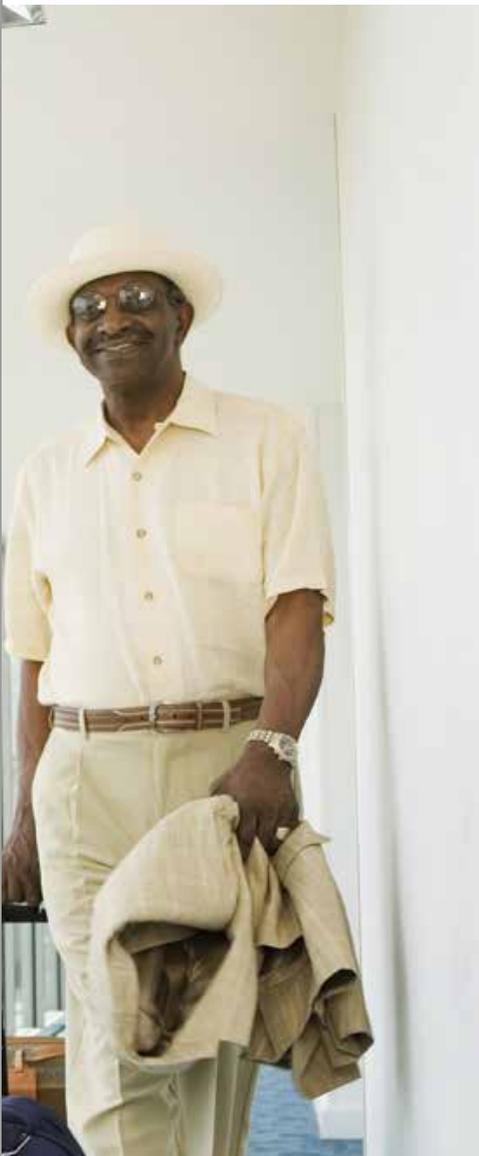
▶ **Feedback loops**

Arivale's business model highlights how preventive medicine and wellness can be taken directly to individuals who are not yet, or might never become, a patient. Arivale offers customers four health paths. Genetic, blood, saliva, gut microbiome and lifestyle data are collected, analyzed and evaluated, helping individuals make lifestyle and health decisions.¹³

Counsyl,¹⁴ a start-up, helps individuals make decisions about their own and their children's future via pre- or post-conception genetic testing, potentially enabling a healthier future by identifying risks for disease. Skinvision¹⁵ and Neurotrack¹⁶ are two businesses focusing on early disease detection for melanoma and Alzheimer's, respectively.



Business models will need to (be allowed to) evolve to include alternative paths to prevention or anticipation of disease.



Lastly, Health Nucleus, a venture by Human Longevity,¹⁷ aims to provide both self-paying individuals as well as up to 200 million South African and UK residents insured by Discovery, with whole exome, whole genome and cancer genome sequencing. The company intends to create the world's most comprehensive database of whole genome, phenotype and clinical data.

In Japan, Daiichi-Sankyo¹⁸ announced it is looking to obtain real-world data to gain insights into non-valvular atrial fibrillation in elderly Japanese. Its ANAFIE study collects data, investigating the status of the use of anticoagulants and their impact on outcomes, and thus aims to identify issues that are barriers to ideal treatment in this population. It further aims to define risk factors for thrombotic and bleeding events, and thus determine the population for which direct oral anticoagulants may provide benefits.

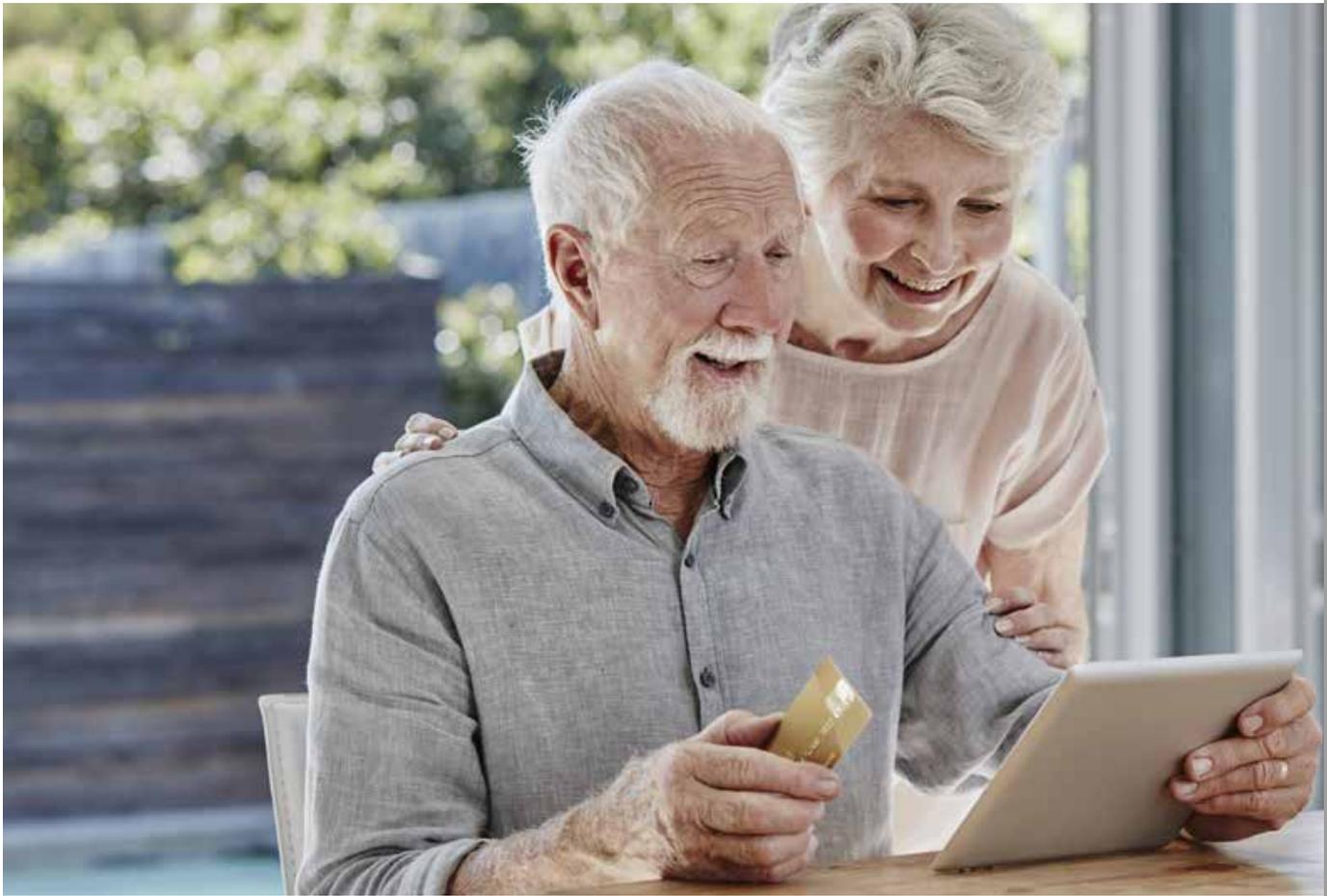
► **Other innovative approaches**

Bayer¹⁹ has initiated digital activities in the Asia-Pacific area, aimed at the elderly, with its Grants4Apps® Singapore project, looking for solutions to improve medication adherence in elderly people with chronic conditions.

Other innovative approaches to treat disease include the field of bioelectronic therapies, where Verily Life Sciences partnered with the pharmaceutical industry to codevelop products for chronic diseases such as arthritis, asthma and diabetes. In addition to bioelectronics, AI and deep learning have been linked to pharmaceuticals and utilized by businesses, including Life Extension™, which recently signed a collaboration with Insilico Medicine,²⁰ aiming to develop anti-aging technologies.

13. <https://www.arivale.com/your-journey/>, accessed 17 February 2017.
 14. <https://www.counsyl.com/>, accessed 17 February 2017.
 15. <https://skinvision.com/>, accessed 17 February 2017.
 16. https://neurotrack.com/#/?_k=434zj4, accessed 17 February 2017.
 17. "Human Longevity, Inc. Launches the Health Nucleus, a Comprehensive and Personalized Health Platform for Individuals," [humanlongevity.com](http://www.humanlongevity.com), <http://www.humanlongevity.com/human-longevity-inc-launches-the-health-nucleus-a-comprehensive-and-personalized-health-platform-for-individuals/>, accessed 17 February 2017.
 18. "Daiichi Sankyo Announces Large-Scale Registry of Nonvalvular Atrial Fibrillation in the Elderly," [daiichisankyo.com](http://www.daiichisankyo.com/media_investors/media_relations/press_releases/detail/006520.html), http://www.daiichisankyo.com/media_investors/media_relations/press_releases/detail/006520.html, accessed 17 February 2017.
 19. <https://www.grants4apps.com/singapore/>, accessed 17 February 2017.
 20. "Life Extension™ joins with Insilico Medicine to develop advanced anti-aging technologies utilizing artificial intelligence," [prnewswire.com](http://www.prnewswire.com/news-releases/life-extension-joins-with-insilico-medicine-to-develop-advanced-anti-aging-technologies-utilizing-artificial-intelligence-300280735.html), <http://www.prnewswire.com/news-releases/life-extension-joins-with-insilico-medicine-to-develop-advanced-anti-aging-technologies-utilizing-artificial-intelligence-300280735.html>, accessed 17 February 2017.

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3. Exploring new territories

In addition to novel molecular treatments, the repurposing of drugs, identification of biomarkers and geroprotectors, further improvements in the area of medical devices, in vitro diagnostics and telehealth technologies – with a special focus on homecare – will likely have a pronounced impact on aging societies.

► **Case example: Homecare**

Governments have identified homecare as a key area with immediate need for improvement. Research conducted in Japan illustrates that many elderly people can maintain independent lifestyles with only minimal support.

IBM, Apple and Japan Post (JP)²¹ have begun an initiative that connects elderly people and their families directly with the health care services community. The aim is to

improve patient quality of life by bringing app-based services such as reminders, alerts, exercise and diet updates as well as community activity opportunities to over five million households by 2020. Eisai²² has identified similar opportunities and partnered with Nippon Telegraph and Telephone (NTT) to roll out a program for medical treatment and care, allowing elderly people to continue to live in their communities. The collaboration, named Hikari One Team SP, aims to use the expertise of all parties to deliver a comprehensive solution, and give peace of mind and safety to elderly people and their families at home.

Remote monitoring and telehealth provide further opportunities for pharmaceutical businesses to collaborate, and be closer to customers. Japan, a global leader in robotics

and AI, has seen a vast increase in investments into robotics aimed at the homecare and care home market. Numerous robots exist, many of which will become part of a US\$6m real-world study by Japan's Agency for Medical Research and Development, investigating their therapeutic effects in nursing homes.

These examples show that opportunities for innovation may come from radical and new collaborations that initially seem unlikely. Collaborations with robotics manufacturers could become critical as they may provide much-needed data that may be required for the reimbursement of therapies. Further, the value lies not only in outcomes data, but also in the understanding of customers' routines, daily struggles and challenges.



Business models

These examples show that the life sciences industry has already embraced some of the challenges and opportunities that an aging society brings. Businesses currently attempt to identify opportunities within the reach of their present therapeutic areas and strategies, but in many cases do not go beyond that. While proven business models are indispensable, partnering with digital, IT and technology firms experienced in data collection and interpretation will become essential. Access to data still remains the biggest challenge for companies attempting to gather outcomes information. Business models will need to (be allowed to) evolve to include alternative paths to

prevention or anticipation of disease. This can only be done via a collective push and comprehensive alignment between all stakeholders.

There is clearly no single solution to managing the changing landscape of aging societies. Pharmaceutical professionals will need to address many questions to remain competitive. The impact of the aging society will need to be evaluated regularly with dedicated teams and closely aligned with regulators, governments, academics, payers and potentially disruptive players.

To rise to the challenge and make appropriate strategic decisions, we will need to answer questions such as:

1. What are the current needs of the elderly and what will they be in 10 to 15 years?
2. How can these needs be addressed through molecular innovation, services or new approaches?
3. How can new solutions be delivered best, and with which partners?
4. How should we make the case for the value these solutions will provide, and to whom? How will they be reimbursed and paid for?
5. What data can and needs to be collected, and how?

6. What is the optimal portfolio of molecular innovation, services and new approaches to capture the current opportunity, while getting ready for the future?
7. What are the innovative technologies or potential partners that are emerging and how can they be utilized to deliver disruptive services?

In this patient-centric world, likely one of the best places to start is by asking the affected population itself: what are elderly people worried about, what are their struggles and what is it they need? ■

21. "Japan Post Group, IBM and Apple Deliver iPads and Custom Apps to Connect Elderly in Japan to Services, Family and Community," apple.com, <https://www.apple.com/pr/library/2015/04/30Japan-Post-Group-IBM-and-Apple-Deliver-iPads-and-Custom-Apps-to-Connect-Elderly-in-Japan-to-Services-Family-and-Community.html>, accessed 17 February 2017.

22. "NTT IT, NTT East and Eisai Rollout Interprofessional Collaboration Business for Medical Treatment and Care," eisai.com, <http://www.eisai.com/news/news201649.html>, accessed 17 February 2017.