

THE NEW MAP of LIFE



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Introduction

We launched Stanford Center on Longevity's New Map of Life initiative much as explorers always have, setting off for a destination fixed in our minds without a clear route to get there. We were time travelers, seeking a point in the near future when human lives would routinely reach 100 years. That year is quickly approaching - demographers estimate that by 2050 reaching the age of 100 will be routine, continuing a remarkable upward trend in life expectancy, which doubled between 1900 and 2000 in the U.S. as a result of reductions in infant mortality, advances in sanitation, medicine, and the widespread implementation of public education. Taken together, these improvements added 30 years to the overall American life expectancy, from 47 years in 1900 to nearly 77 years in 2000. Average life spans will continue to rise in the U.S., despite the grievous impacts of the COVID-19 pandemic and deepening racial disparities.

The near doubling of human life expectancy in the U.S. and other economically advanced nations ranks as one of the greatest achievements in human history. Yet it came at such speed that the social institutions, economic policies, and social norms that evolved when people lived for half as long are no longer up to

the task. The resulting narrative around an "aging society" seems to convey only a crisis, ignoring obvious opportunities to redesign those institutions, practices, and norms and bring them into sync with the health, social, and financial needs of 100-year lives. No generation has reached this 100-year milestone en masse before, and there isn't a cultural script akin to "It Takes A Village " for the journey.

So we decided to write one.



Our goal is to advance a new narrative that explores the more meaningful concept of longevity, the duration of life, and to identify actionable steps for enhancing the quality of longer lives. By drawing a distinction between the biological process of aging and the conditions that support long life, we focus on optimizing well-being at all stages of life for all people, starting at birth.

Our script dispenses with the notion that longevity and aging are one and the same – a long slide that at some point becomes a white-knuckled plunge into frailty, dependence, and irrelevance. The advent of 100-year lives coincides with declining birth rates, and these two defining demographic trends are often conflated into a crisis narrative about an aging society about to be engulfed by a “gray tsunami.” Our goal is to advance a new narrative that explores the more meaningful concept of *longevity*, the duration of life, and to identify actionable steps for enhancing the quality of longer lives. By drawing a distinction between the biological process of aging and the conditions that support long life, we focus on optimizing well-being at all stages of life for *all* people, starting at birth. Changing how we live changes how we age, and a different course of life holds the promise of tremendous opportunities that have been obscured by the “grey tsunami” mentality.

As the population distribution shifts to include more older people than young children, it signals a profound transformation for a society whose iconography is rooted in youth and vigor. We recognize that each stage of life brings its own developmental milestones, distinct health and emotional needs, family and social roles, relationships and responsibilities, financial risks, and opportunities. What happens along any of those dimensions during earlier stages of life affects all the stages that follow, for the better or for worse. In our story, early childhood merits as much of a makeover as old age, and midlife is as fitting a time to launch or pivot as is adolescence.

The New Map of Life extends well beyond the terrain of old age for this reason; it is our vision for engineering the entire life course with at least 30 more satisfying years of vitality and

engagement, years that can be spent discovering, connecting, creating, producing, and above all, experiencing a sense of belonging, purpose, and worth.

This whole-of-life approach is critical because to realize the opportunities that longevity affords, we must remedy the inequities that have so far prevented too many Americans from experiencing the benefits of longer, healthier lives due to their race, place of birth, or socioeconomic status. Becoming a longevity-ready society impels us to address longstanding race- and class-based disparities in healthcare, education, housing, and other social goods that hinder the opportunity for all Americans to experience longer, healthier lives.

Achieving longer, healthier lives for the full population is, to us, the cornerstone of success. As a nation, we can –and must– invest in ways that benefit all, starting with improving the trajectory earlier in life for children in neighborhoods without safe and healthy places to play, learn, and grow, key environmental conditions that support longevity.

In 2018, the Center launched the New Map initiative with a convening of world-renowned experts that included academics from a wide range of disciplines, stakeholders and policy makers, industry executives, and thought leaders. With the premise that once we articulated the challenge, we would have the collective wisdom to build solutions. Arguably the most pernicious aspect of a crisis mentality is that it mutes aspirations – and we cannot achieve what we cannot envision.

For two days, we shared evidence, debated ideas, and began a conversation that alternated between wild optimism and clear-eyed constraints surrounding futures that last

decades longer than any imagined by our great-grandparents. At the close of the meeting, the need for deeper understanding of the core aspects of life was clear. To explore new options for the life course and its many variables, we created a post-doctoral program and appointed an interdisciplinary team of talented fellows with expertise in nine domains we identified as core to longevity: early childhood, education, work, financial security, built environment, environment and climate, health and technology, lifestyle and fitness, and intergenerational relationships.

For two years, these fellows and their faculty advisors outlined what is, and what could be, within these critical domains. We created a weekly seminar for the fellows to provide a unique course on longevity from dozens of perspectives. In parallel, we expanded our thinking and informed our ideas with global perspectives from colleagues including Professor Andrew Scott, from the London Business School, Jack Rowe, leader of the MacArthur Network on Aging Societies, Michele Barry, Director of Stanford's Center for Innovation in Global Health and John Wong, from the National University of Singapore.

Central to our approach is a forward-facing view of the economic potential for a more age-diverse population in which older adults contribute in significant and measurable ways to the social good and to the GDP, in strong contrast to the outdated assumption that older adults drag down productivity and drain societal resources. Scott, who specializes in longevity and fiscal policy at the London Business School, noted that rising life expectancy coupled with lower birth rates presents real challenges for governments and societies, but that many of those challenges are not as insurmountable as we think, and that we must correct our outdated assumptions

around the health and productivity of older adults in order to accurately measure costs and benefits. Scott noted traditional measures of GDP only focus on paid labor and have no way to capture the value of caregiving and volunteer hours that many older adults perform, even though many workers 65 and older were also more active in the workplace than most models assumed. Misguided policies and cultural myths are fed further by the tendency in marketing and media to lump older adults ages 65 to 95 into a single monolithic demographic. In fact, older adults are more diverse than other population segments in terms of health, activities, employment, and financial status.

We tasked ourselves with developing ideas to optimize life across *all* stages and challenging the assumptions and norms of a conventional life course that have changed little over the past century. Even though human life expectancy has doubled over that same period, the social scripts and norms that guide people through life haven't budged. The prevailing, outdated model consists of three linear and distinct stages –education, work, and retirement– defined in large part by the roles we play at any given time in our lives.

In this traditional model, people are assumed to trundle from one stage to another, as though on a conveyor belt: a student until their early 20s, a worker until the age of 65, and a retiree in whatever years remain. As we move along, we are assumed to form families, raise the next generation, and acquire assets to be handed off to those behind us once our ride comes to its inevitable end. The conventional model assumes people to be married, and marriage is assumed to provide a financial safety net for the lower or non-earning partner, who is available to watch over children 24/7.

There is little accounting in the 20th century

model for family structures that are different or disrupted, or for the deep, systemic disparities imposed by race, gender, poverty, health, or other factors. There are too few opportunities for altering the set course, for sliding safely off the conveyor belt when circumstances demand, or for gliding back on when circumstances permit, for changes in fortune, health, mind, or heart – the traits and foibles that make us human.

The New Map of Life incorporates multiple, flexible, less linear routes through the roles, opportunities, and obligations that life brings. We envision more on-ramps and off-ramps from the decades of life dedicated to paid work, more opportunities for informal learning and lifelong learning, for intergenerational partnerships that improve the flow of knowledge, support, and care in all directions, as well as ample opportunities for correcting course when the inevitable bumps, curves, and roadblocks knock us off our stride – or changing course for new opportunities.

Rather than tacking the longevity dividend we've been gifted over the past century onto the end of life – as we have tacitly done – we envision adjusting the conveyor belt to strategically distribute the bonus time throughout all stages of life, so that the benefits can compound for decades. Adjusting the timing of life's milestones gives us more time to savor the benefits of childhood, to establish stable pillars for our personal and professional lives during early adulthood, to reset the course as needed or desired during middle age, with the reset contributing in older adulthood to better health, financial security, and more options for feeling engaged and valued at each stage.

Century-long lives can afford children more time to explore, discover, and create – the foundation

for healthier, happier, more productive lives. And as children grow to be adolescents, there can be more time for them to test acquired knowledge outside the classroom through gap years or semesters throughout their education. There can be more time for young adults to build and care for their families while also advancing their careers; periods of paid and unpaid work can be interwoven throughout longer lives to accommodate training for career changes, caregiving responsibilities, or health needs. Imagine the potential for a gap year (or years) in midlife to reset for the needs and interests in the upcoming decades. Calibrated in this way, working lives can last decades longer, resulting in better health, greater satisfaction and earning power.



We find powerful evidence that redesigning systems and institutions that enable healthier, more productive, longer lives for all will have measurable, positive economic impacts.

As a result, milestones, expectations, and opportunities will shift. New questions are raised. Is reading by first-grade essential to future learning ability? Must young people graduate from high school by 18 and hurtle across the educational finish line, diploma in hand by their early or mid-20s, to achieve success over a 100-year life? Why not make learning a lifelong process and challenge the assumption that education requires a real or virtual classroom and an instructor? Why should 65-year-old knowledge workers be expected to leave the workplace, just as many achieve peak wisdom? Is a chronological number even the

best way to define “age” when science offers so many new tools to measure vitality and health? It isn’t all about looking fabulous at 50 and windsurfing at 90, although that may be a fine way for some to spend their extra years. It is also about the bottom line. We find powerful evidence that redesigning systems and institutions that enable healthier, more productive, longer lives for all will have measurable, positive economic impacts. If the recovery dollars that were appropriated during the pandemic were strategically invested to address intersecting needs, we could lay the groundwork for a society that is healthier, more equitable, and longevity-ready.

The fact that people are living longer signals neither calamity nor crisis, but rather a profound shift. We only create a crisis by doing nothing, and as the ravages inflicted by the COVID-19 pandemic illustrate, the cost of failing to prepare for a known risk – or not preparing adequately – are catastrophic. The benefits of acting early and investing strategically in ways that promote longevity are equally immense in scale, and those and those choices are outlined in the following chapters. While the phenomenon of steep growth in life expectancies extends to most advanced economies, this report focuses primarily on policies and cultural patterns in the U.S. The concept of the New Map of Life can be applied to other economies and societies, and countries have a great deal to learn from the mistakes and successes of others.

If we make the most of the opportunity that 100-year lives contain, more people can lead longer, healthier lives infused at every stage with a sense of belonging, purpose and worth. To realize that potential though, we must start making changes and we need to start now.

Part I: Connection, Community, Health and Climate

CHAPTER 1 | If We Do Nothing

The year is 2050 and the average life expectancy at birth is 100. The oldest millennials are turning 70, with lower rates of savings and home ownership than any generation since the Great Depression. Social Security reached insolvency in 2035, imposing benefit reductions on an already stretched generation, and on all who retire from now on. Birth rates have cratered, a trend that began in the 20th century as economic opportunities for women expanded, while paid parental leave, affordable, high-quality childcare and preschool, and flexible employment options remained for most a mirage.

While life spans are longer, health spans are not. One half of children in the United States are obese, as are two-thirds of adults, and obesity-related conditions absorb a third of all healthcare dollars. Tech giants dominate healthcare markets, applying big data scraped from smart devices and previous purchases to predict the age-related diseases and chronic conditions likely to strike their customers. That data can drive early interventions and prevention; it can also be mined by private insurance companies, who have their own technologies for circumventing privacy measures, to shape more profitable customer pools.

Yet the people most at risk remain uninsured, or dependent on Medicare, whose funding consumes an ever-larger share of GDP.

The youngest children spend ever more time indoors on screens, rather than playing and discovering nature, and are on a trajectory for poorer physical and emotional health than previous generations, as “nature deficit disorder,” identified by author Richard Louv in 2005, becomes the norm for children. Access to higher education is predetermined to an even higher degree by socioeconomic status and race in 2050, in an economy where automation and artificial intelligence have eliminated many of the occupations available to those without a college degree, still the singular, defining standard for most middle-class jobs.

The “lost generation” of children who did not return to school or recover from learning losses during the COVID-19 pandemic of 2020-2022 are now un- or underemployed adults, with children of their own. Children living in poverty and underserved communities still fail at distressing rates to learn to read by 3rd grade, a precursor for dropping out and a higher likelihood of future incarceration.

Climate change shapes life everywhere for everyone, with disproportionate impacts falling on people of color and those who are low-income and older. American cities are hotter, suburbs are routinely ravaged by wildfires, and drought decimates rural communities. Climate refugees add pressure on strained housing and job markets.

Racial inequities have deepened, especially for many Black Americans living in neighborhoods lacking clean air, safe water, stores to buy nutritious food, and access to green spaces where residents can play, exercise, and soothe stress. The median Black family has a net worth that is still around 12 percent of the median white household, due largely to the trillions of dollars in missing intergenerational wealth related to lower rates of home ownership for Black families, rooted in discriminatory government lending policies that persisted into the 1970s and in discriminatory banking practices that continue to the present.

In suburbs, housing and transportation patterns have changed little since the 1950s. An increasing number of older adults no longer able to drive are marooned in neighborhoods designed and built a century ago for two-parent nuclear families with a stay-at-home mom to drive kids to school and swim practice, despite the fact that only a small minority of households reflect these assumptions. With mass transit scarce, the autonomous vehicle fleets that knocked Uber and Lyft out of business in the 2030s are too expensive for most retirees, and those unable to afford grocery delivery or a taxi are cut off from nearby sources of fresh, nutritious food.

The Digital Divide has become a chasm, leaving poor and rural Americans cut off from education, jobs, and healthcare services in a digitized

economy. Digital redlining and social isolation have further segregated Americans by income and age. Portrayals of intergenerational conflict proliferate in the media, driven by resentment, misinformation, and disconnection.

This scenario of the “gray tsunami” washing over the land is a worst-case extrapolation of the “aging society” media narrative. Such stories typically start with a cursory nod to the advances in science, medicine, and hygiene that led to the doubling of human life spans between 1900 and 2000 – after all, it’s hard to argue against reducing infant mortality. Then comes the twist: rather than regarding the advent of 100 year lives as more good news, longevity morphs into a demographic calamity that threatens the social and economic order.

This genre inevitably caricatures older adults, whether 65 or 95, staring wistfully at the horizon or fretfully at their bank statements, sitting idly on benches, trading arthritis tips or being tended by smiling caretakers. A cover of *The Economist* from 2014 shows umbrella-toting pensioners raining from the sky onto rooftops, with the headline “Age Invaders.” Unlike Mary Poppins fluttering in to enchant the children in her care, this deluge of elders is presumably coming to siphon resources better dedicated to those children’s upbringing. While a recent counter-trend may feature pink-haired grandmothers on skateboards and garage band reunions of aging Boomer dads, the subtext of all of these caricatures is that older people, no matter how beloved or spunky, represent a net drain on society.

No wonder we are expected to take cover.

What if, instead, we developed a strategy to become a longevity-ready society? A decade ago at Stanford, faculty were beginning to think of

ways that Stanford could innovate transformative approaches for human aging, much as it did for communications technology in Silicon Valley. What began with a handful of faculty quickly expanded to include those from engineering, business, law, humanities and science, medicine, education, and earth sciences who saw a shifting population as an exciting challenge in search of solutions.

Laura Carstensen and her colleague, neurologist and stem cell biologist Thomas Rando, were deputized to establish what became the Stanford Center on Longevity and were given the mandate to apply science, technology, and behavioral and social change to improve longevity. Carstensen had spent most of her career studying cognitive, emotional, and motivational changes that unfold across the life span, notably detailing ways that aging benefits emotional well-being and interests in helping others. Rando's research was revealing ways to slow the biological processes that place people at increasingly greater risk for disease as they grow older.

Both held similar perspectives about the scientific aims, both stressing the important distinction between a Center on Longevity and *for* Longevity, meaning that the Center wasn't going to advocate for *extending* life—a phenomenon already underway—but rather to apply science, technology, and policy to make longer lives *better*.

By design, SCL came to include senior staff with deep expertise outside of academia and engaged a council of distinguished advisors who brought deep knowledge about how to make change at the societal level, how to distribute ideas and products, and how to bring to scale new ways of living. Given the aim of transformative cultural change, the center's work focused squarely on

impact. SCL forged relationships with businesses and corporations that were interested in collaborations to implement and evaluate novel solutions for the range of challenges they faced.



The New Map of Life is relentlessly forward facing, appreciating the flaws inherent in designing solutions for the future based on the problems of the past, and in coloring within the lines of today's known facts rather than imagining new ones.

Today the Center's affiliated faculty includes as many pediatricians as geriatricians, along with economists, sociologists, and innovators in science, medicine, public health, technology, education, finance, transportation, design, culture, and media. As central to SCL's mission as science and technology was, SCL recognized the need to change the narrative about coping with aging to one about discovering and pursuing new opportunities.

The New Map of Life is relentlessly forward facing, appreciating the flaws inherent in designing solutions for the future based on the problems of the past, and in coloring within the lines of today's known facts rather than imagining new ones. A static view of what it means to age distorts our future perspectives about longevity, and our measure of the costs and benefits. As Carstensen wrote in 2011 in *A Long Bright Future*, "The danger that lies ahead for our society is that by failing to creatively and proactively adjust to life span changes, we will condemn the old people of the future to live like the old people of the past, even though they will be healthier, more mentally agile, and capable of doing much more."

Meeting this challenge is not the sole responsibility of government, healthcare providers, or insurance companies; it is an all-hands, all-sector undertaking, requiring the best ideas from the private sector, government, medicine, academia, and philanthropy. For us, it is not enough to reimagine or rethink society to become longevity-ready; we intend to build it, and fast. Our collective challenge is to develop social innovations that will help people remain healthy and productive over the course of their longer lives.

The New Map of Life is about much more than taking a different course from Point A to Point B; it is about changing the field of vision, the navigational tools, and modes of transportation to get us across entirely different terrain. Think Mars Rover instead of a steamship or a train. Shoving off across *terra incognita* requires overcoming the psychic inertia that is part of human nature. “We are enmeshed in a collaboratively written life script that is intensely, but invisibly powerful,” Carstensen writes. “Even though it’s forcefully shaping our ideas about aging and where certain events should occur in our life span, we rarely realize it’s there.”

Another key design principle of the New Map of Life is flexibility. While the conventional life course is a one-way road through three life stages –education, work, and retirement – the New Map of Life features forks in the road that can take us in many directions. There are intersections, cloverleaves, curves, on-ramps, and off-ramps. Flexibility is the mantra and course corrections are the norm. Those who must veer at one point or make a U-turn at another deserve support for their resilience in the aftermath of a mistake, miscalculation, or misfortune. Adversity may be inevitable in life, but a central design feature of the New Map of Life is that it need not become indelible. For

For example, labels such as “dropout”, “unemployed,” “homeless” or “ex-con” are common yet derogatory shorthand for describing a person’s past experience that also serve to dismiss their potential for growth, or as an excuse to deny the societal resources to assist them in doing so. A recognition that adversity is more common –and less limiting– than the conventional narrative allows will make us more resilient as individuals and as a society.

American culture values ingenuity, individual choice, responsibility, and virtues such as a strong work ethic. These qualities, along with making good decisions and having a supportive family, are assumed to propel us over the hurdles of life, and for many this is true. But the dominant cultural script makes few allowances for the hurdles at birth that hinder children born into poverty, racial discrimination, or the wrong zip code from even getting to the starting line, much less reaping the benefits of longevity.

In a democratic society with an advanced economy that depends on the participation and talents of all members, failing to create opportunities for each person to develop their full potential is an unconscionable waste. The policies and investments we undertake today will influence how the current young will become the future old, and what we choose –as individuals and as a society– to make of the thirty extra years of life gifted to us.

CHAPTER 2 | 'I Feel Needed'

When Natalie Orange retired at the age of 64, after 38 years as an elementary school teacher in Los Angeles, she imagined she would relish her freedom and some peace and quiet. Instead, a few weeks into what would have been her 39th school year, she started to feel adrift without her daily routine, and isolated without the interactions she was accustomed to at school. By the end of September, she was waking up in tears. "I was prepared to relinquish the extreme amounts of paperwork but didn't realize how much I would miss my daily interactions with the children and my friends," she says. "I just started to dissolve into a state of depression."

On one especially bad day, Natalie called her doctor and was surprised by what he prescribed. "He told me, 'Girl, you need a job!'" she recalls. "Maybe not a job-job, but he told me 'you have to get out of the house and get back to being with people.'"

On her sister's recommendation, Natalie enrolled in Generation XChange (GenX), a partnership between UCLA Department of Medicine and the Los Angeles Unified School District that trains older volunteers as tutors and places them in elementary schools in some of LA's most underserved neighborhoods, to study the health effects of volunteering on older at-risk adults. The volunteers, most of them retired African-American women between 60 and 80 years old, received health and wellness training as part of the program.

She was assigned to tutor first graders at a nearby magnet elementary school in LA's Windsor Hills neighborhood, where she quickly noticed that the overwhelmed, young teacher

she was assigned to support didn't have the right classroom supplies. She whipped up a supply list and coached the teacher on how to advocate within the school district for more reading manuals; she also discreetly offered tips for instilling discipline with some of the unruly first-graders. "The disrespect I see is not going to fly with me," Natalie told the young teacher, offering a plan to set and uphold new rules with the children.

When the pandemic forced schools to close, GenX provided Natalie and the other volunteers with laptop computers and hotspots and a crash course in using Zoom. Natalie switched to tutoring in an online breakout room, patiently showing a struggling 6-year-old named Amiyah how to sound out letters, to spell, and to recognize 200 sight words.

As the child's confidence blossomed, so did the well-being of her mentor. Natalie started volunteering an extra five hours a week, became friends with her teaching protege, and kept tabs with her fellow volunteers during online social hours. Taking advantage of health tips from the workshops GenX offers its volunteers, she is walking every day, drinking cinnamon-infused water instead of sodas, and even attending online workouts with a teacher who calls himself the "Guru of Abs." After more than a year, her energy is up and her weight is down to the point that her sister started teasing her about needing new pants that fit better. Best of all, Natalie's depression has lifted. "I feel like I'm myself again," says Natalie. "I feel needed."

That sense of purpose, *eudaimonia* to Greek philosophers, was defined by Aristotle as "the

best of all human goods” and “a state of flourishing and purpose in life.” Psychologist Erik Erikson, who developed the 8 life stages of psychosocial development, posited that the developmental task of adults in their 60s is “generativity vs. stagnation.” Those who find meaningful ways to contribute to the development of others and have a positive impact on society tend to flourish, while those who do not may feel they are not leaving a meaningful mark on the world, and lose interest in connecting with others, trying new things, and in improving themselves.

As a physician practicing geriatric medicine in the late 1980s, this was a syndrome Dr. Linda Fried had seen many times. Now Dean of the School of Public Health at Columbia University Medical School, Fried also developed a practice of prescribing a search for one purposeful activity for her patients struggling with depression and no reason to get up in the morning after they retired. Fried recalls a newly retired CEO who came for treatment after “he went from being King of the Hill to being invisible and nonexistent.” The man took Fried’s prescription for purpose and went to a community organization he supported. “They put me in the corner licking stamps,” he told her at their next appointment. “I have so much more to give, as much as I did three months ago as CEO, and I don’t want to spend the rest of my time on Earth licking stamps.”

Through clinical experiences like this and research analysis, Fried realized there were no societal institutions to capture the capabilities of skilled, older adults like her patients. “We have this breathtakingly exciting package of human potential the world has never seen, unprecedented numbers of people with unprecedented capabilities, and significant desire to give back and leave the world better

than they found it,” says Fried. “But the policy metrics tell us that this untapped potential has no value to society, it’s just a bunch of worthless old people. And when this human capital is not valued, our social institutions have no way to deploy this resource.”

After several years of research to develop an understanding and vision of the valuable untapped social capital of older adults, and then developing a national proposal for a new type of senior volunteer program for older adults that could deliver both high impact to recipients and health to the volunteers, Fried teamed up with social entrepreneur Marc Freedman and in 1996, they co-founded Experience Corps (now AARP Experience Corps). She proposed starting the model with Senior volunteers supporting the success of children in public elementary schools, which is what was done.

Originally a federally-funded national service project to harness and deploy the skills of older adults as volunteers in public schools in five U.S. cities, Experience Corps was the first evidence-based model designed for high impact for three groups of beneficiaries: children, older adult volunteers, and teachers. At-risk children received critical support learning to read, schools saw increased teacher retention, and older volunteers found meaningful, generative engagement, made friends, and had improved physical and mental health. “It was win-win-win,” says Fried.

Scientists can now track precisely how eudaimonic well-being affects physical health. Over the course of a school year, most of the Generation XChange volunteers lost weight, and many saw reductions in blood pressure and improvements in cholesterol levels. Researchers at UCLA conducted a pilot study on some volunteers and preliminary data found clear

biological pathways linking pro-social behavior such as volunteering to a host of metabolic changes, including beneficial regulation of immune cell genes that contribute to cardiovascular and neurodegenerative diseases, cancer, mood disorders, and frailty.

There were also benefits researchers did not anticipate. “We were stunned by how quickly the volunteers bonded not only with the kids, but also with the principals and teachers,” says Dr. Teresa Seeman, Professor of Medicine and Epidemiology at UCLA, and a former collaborator of Fried’s, who led the study. “We are in hard schools, with kids who have experienced trauma, and they love working one on one with an older adult who may feel like a grandparent. We have teachers saying, ‘I don’t know how I would have survived without my GenXer.’”

Measuring the multigenerational benefits of such programs has political and policy implications. When Fried and Freedman launched Experience Corps with federal funding in 1996, during the Clinton Administration, Fried says the research team was instructed to measure only the literacy benefits to at-risk children, and not the health benefits to older volunteers, even though such collateral benefits were a key goal of the program design. “The political mindset seemed to be, ‘it is valuable to show that older adults can be deployed to help others, but not to show that the investment also helps the health and wellbeing of the older adults too.’” Fried’s design intended both, and she went on to show that both benefits occur and lead to a higher ROI together.

In light of the ample anecdotal and clinical evidence pointing to the benefits of intergenerational partnerships such as these, the media portrayals pitting generations against each other and ongoing age segregation of American

society are clearly counterproductive. Young people who have a meaningful relationship with an adult who is not a parent (e.g., an aunt or uncle, sports coach, clergy member or tutor) are more likely to do better in school, to display less risky “problem” behaviors, to be more independent, and to have fewer depressive symptoms than those without such caring adults in their lives.^{1,2,3}

Among youth who do have these relationships, the quality matters: young people who experience more warmth, closeness, and acceptance from adults around them have better outcomes.⁴ These relationships seem to be most impactful for otherwise at-risk youth, who face barriers to success due to the resources in their family or community.⁵ Marc Freedman, who subsequently founded and leads Encore.org, maintains that the goal of later life isn’t trying to stay young; it’s to be there for those who actually are.



There is not yet a comprehensive measure for the broader social benefits that come from recognizing and rewarding the contributions of older adults, as they make up an increasingly large portion of the population. That leaves instead the outdated, three stage life course, with an economic role assigned by age.

The multigenerational benefits of the connections fostered by programs like Experience Corps, Encore.org’s Gen-to-Gen program, and Generation XChange can be measured only in part by changes recorded in cholesterol levels, reading scores, or reduced stress for teachers. There is not yet a comprehensive measure for the broader

social benefits that come from recognizing and rewarding the contributions of older adults, as they make up an increasingly large portion of the population. That leaves instead the outdated, three stage life course, with an economic role assigned by age: workers are assumed to be more valuable than retirees, and students are valued as future workers, creating an intergenerational pecking order in which older adults are inevitably at the bottom, assumed to be an economic drain on society.

In this alarming scenario, the only remedy for more old people is more young people, whether through pro-natal policies by governments to boost birth rates, or through immigration. A recent front-page story in the *New York Times* on global population decline warned that “the strain of longer lives and low fertility, leading to fewer workers and more retirees, threatens to upend how societies are organized—around the notion that a surplus of young people will drive economies and help pay for the old. It may also require a reconceptualization of family and nation.”⁶

The BBC, reflecting on the same data about dramatically declining fertility rates around the world, asked: “Who pays tax in a massively aged world? Who pays for healthcare for the elderly? Who looks after the elderly? Will people still be able to retire from work?”⁷

The need to overhaul the retirement model and the financial products and policies it is built upon is without doubt a valid and urgent concern that will be addressed in Chapter 7 of this report. These are critical questions, yet they address only part of the equation. In challenging the narrative that longer lives and fewer births means an intergenerational resource competition that can only end in calamity, the New Map of Life poses a different set of questions, designed to elicit

creative and specific solutions:

- How do we tap the unrealized contributions and skills of older adults and share them with younger generations, in communities, schools, and workplaces?
- How do we replace the one-way career path that leads people into unwanted or unplanned retirement for people experiencing illness or disability in their 50s or 60s, and instead create new options for people to re-enter the labor force as able or needed, allowing for more years, even decades, of paid work, which dramatically changes the retirement cost curve?
- How do we extend the benefits of longevity to more people, especially children disadvantaged from the start by racism, poverty, or an unhealthy environment?
- Which public health, medical, and technological innovations will extend the health span of the greatest number of people, allowing them to remain in the workforce, and driving down the aggregate costs of care?
- How can a more fluid and flexible life course allow for periods of earning and non-earning throughout life, extending working lives and building financial security, while also creating new cultural norms such as gap years for new parents, and people in midlife facing career transitions or eldercare needs?
- How do we incorporate into the New Map of Life the specific needs of people in rural communities, as well as those of people who perform physically demanding labor that cannot be sustained for additional decades?

In 1900, when life expectancy in the U.S. rose to 47 years on average, about four in ten people were under the age of 20, while only six percent were over the age of 60. Today, there are relatively equal numbers of people in every age group, from birth through their 70s, ushering an era of unprecedented age diversity, which is a more accurate description than an “aging society.”

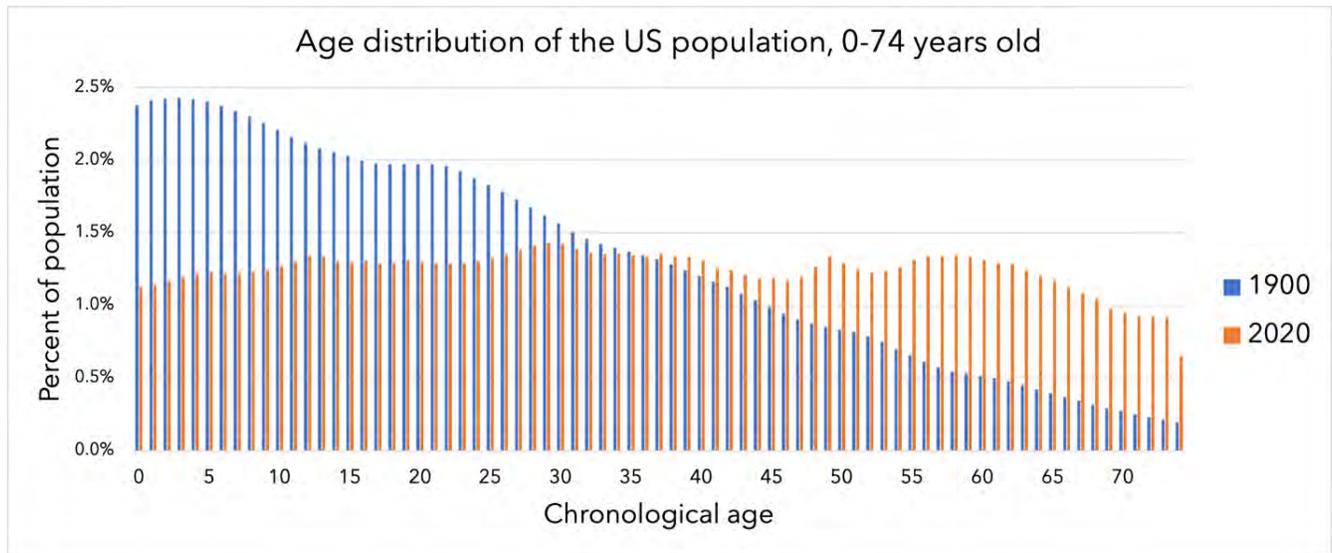


FIGURE 1: Age distribution of the US population, 0-74 years old, in 1900 and 2020. Data from US Census Bureau population counts and estimates; analysis by Sasha Shen Johfre

For the first time, four or even five generations of the same family can be alive at the same time, creating decades of opportunities for intergenerational connection that humans have never had before. With life expectancy hovering around 30 years until the early 1800s, for much of human existence people had enough time to pass on their genes, and not much more. Even in 1900, only six percent of American children had four living grandparents; by 2000, that figure had risen to 40 percent.

Frazzled parents everywhere know how useful having extended family nearby can be. And the benefits extend in multiple generations. Within families, research suggests that older adults who help their children and grandchildren experience mental and physical health benefits.⁸ Modern medical science aligns with ancient wisdom in identifying these intergenerational connections as the building blocks of well-being and longevity. Only in relation to others can human infants survive, and children acquire the skills to care for themselves. As we move through life, it is through our relationships with others and the natural

world around us that people find happiness and purpose, and come to define their identity and worth as an individual. Along with feeling connected, being able to maintain purpose or find renewed purpose is critical over the course of longer lives, which now extend decades beyond the reproductive and child-rearing years.

Today, older adults have not only the time, but also the luxury of nurturing young people who are not even related to them. We need a new accounting system that assigns meaningful value to the essential contributions of older people that can't be easily monetized or otherwise quantified. This is a critical step to accurately understanding how the presumed costs of an "aging" society are offset by the benefits of age diversity. How can we optimize these overlapping decades to nurture the young and to share caretaking responsibilities for young and old alike? In a society starkly segregated by age, how do we create more opportunities for intergenerational connection and the intangible benefits of knowledge transferred by people rather than gleaned from Google?

The same potential benefits extend to workplaces, where up to six different birth cohorts (people born in the same decade) may now share responsibilities, while learning from each other and challenging each other's perspectives. While the conventional narrative holds that older workers are less productive and healthy, and just don't "get it" when it comes to technology, the evidence shows that older workers in knowledge jobs are in fact superior in attendance, judgment, and mentoring skills. "Companies are saying 'We have these lovely, experienced employees in business-critical roles,' and they need to retain them," says Yvonne Sonsino, global co-leader of Mercer Consulting's Next Stage program, which advises businesses on managing age-diverse workforces. "One of the most common questions I am asked is how to keep on experienced older workers." Many of the companies Sonsino advises are experimenting with pilot programs to ensure knowledge transfer among workers of different generations, as well as implementing scheduling and retirement options that enable older employees to work additional years, while gaining the additional flexibility they desire.

Although older workers are often thought to have higher salaries than their younger counterparts, especially in certain occupations, salaries in fact tend to rise with promotion and job experience until the age of 50 and then plateau, even falling after this age if the employee stays in the same job. Older workers also have lower absenteeism and lower turnover, leading to overall lower costs to employers.^{9,10} Yet age stereotypes remain powerfully detrimental, because they can be used to justify undervaluing, or even mistreating older workers.^{11,12,13,14} Sonsino believes age bias will fade when employers begin to measure and value age diversity along with other aspects of diversity and inclusion. Her team at Mercer advises companies to include age in all diversity and inclusion reporting and to use the data to plan future workforce needs. "What many companies think of

as a 'time bomb' in terms of older workers retiring at once may actually be a gold mine in terms of experience, if those workers are instead offered ways to phase out gradually and remain valued."

Given the salience of age as a cultural status marker, we must also consider the ways in which age orders nearly every aspect of our lives –where and how we spend our time, where we live and work, and who we interact with on a daily basis. A century ago, when life expectancy was 48 years, people were unlikely to interact with anybody significantly older or younger. With life expectancy at birth now 79 years on average, in theory opportunities should abound to meet, befriend, and learn from people who were born decades earlier or later, and who came of age in profoundly different economic, social, and technological contexts.

And yet, that is not the case. Americans are sorted by age, starting in very early childhood: preschool, elementary school, middle school, and high school. Even within any given school, students are split into classes and grades based on their birth year. Age determines whether we live in a college dorm, a single-family home, or a retirement community. In residential neighborhoods, long segregated by race and socioeconomic status in the U.S., there is also organic age separation. One study found that in order to achieve perfectly age-integrated neighborhoods, nearly half of Americans (43%) would have to move to a new area.¹⁵

In the postwar years, American suburbs were built for the nuclear family, with large lots for privacy, houses big enough for many children, and the assumption that drivers in the household could get everyone where they needed to go. It worked for decades, but as kids grew up and moved away, the parents aged in place, no longer able to mow the lawn, climb the stairs, or drive to the grocery store or the doctor's office, the living arrangements that prevailed for the white

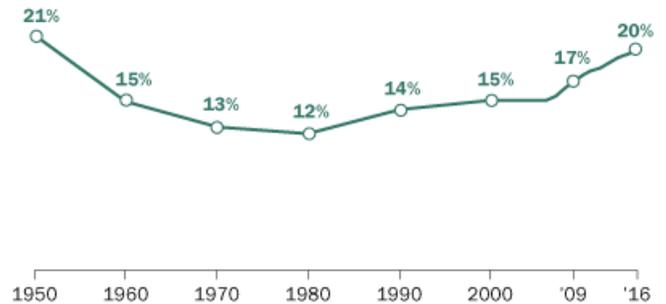
middle class in the 1950s are in drastic need of an update. New paths to home ownership are also overdue for those excluded from home ownership and intergenerational wealth building in the first place, due to racially biased financing policies and zoning restrictions excluding Black buyers and other families of color.

The COVID-19 pandemic revealed harrowing scenes of our age-segregated society and drove a long overdue rethinking of how we live as a multigenerational society. It took a terrible toll on the oldest and frailest residents of nursing homes and other congregant settings, as family members watched helplessly from a distance, unable to even be with their loved ones in their dying hours. We saw poignant images of spouses or adult children and their elderly parents holding their hands up to each other through windows, and of grandparents receiving hugs from their children and grandchildren through plastic curtains.

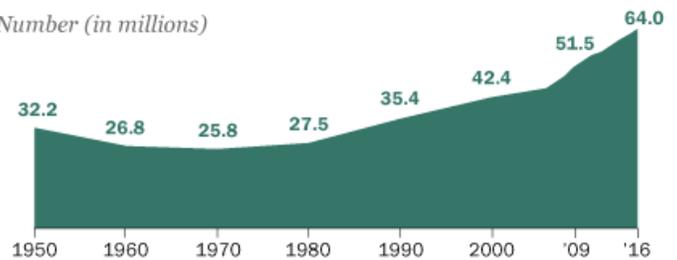
The pandemic also accelerated a trend towards multigenerational living in the U.S. that began around 2000. Between 2009 and 2016, intergenerational living grew by 18 percent, resulting in 64 million Americans living in multigenerational housing.¹⁶ According to a study that began after the start of the pandemic, rates are markedly higher among families of color and immigrant families in the U.S. (Figure 2). And the trend is more evident in high-cost cities, where there is growing demand for houses that can comfortably accommodate three or even four generations, who can share costs and caregiving.

One-in-five Americans live in a multigenerational household

% of population in multigenerational households



Number (in millions)



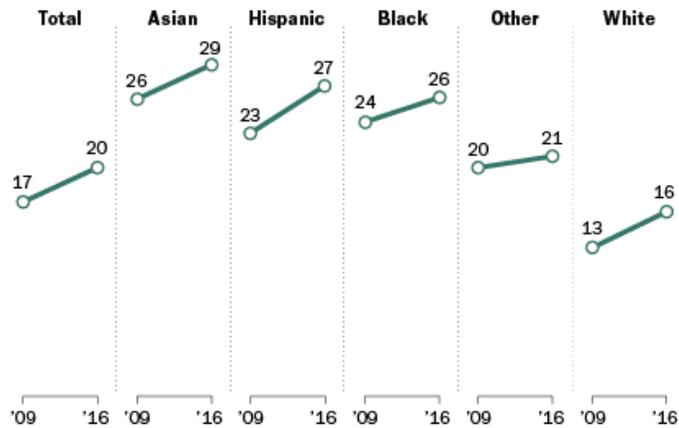
Note: Multigenerational households include at least two adult generations or grandparents and grandchildren younger than 25.
Source: Pew Research Center analysis of 1950-2000 decennial censuses and 2006-2016 American Community Survey (IPUMS).

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Figure 2: American population living in households with two or more adult generations. From Pew Research Center.¹⁷

Whites less likely than other racial and ethnic groups to live in multigenerational households

% of population in multigenerational households



Note: Multigenerational households include at least two adult generations or grandparents and grandchildren younger than 25. Hispanics are of any race. Asians include Pacific Islanders. Whites, blacks and Asians are single-race only and include only non-Hispanics. "Other" includes non-Hispanics in remaining single-race groups or multiracial groups. Source: Pew Research Center analysis of 2009 and 2016 American Community Surveys (IPUMS).

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Figure 3: Percent of Americans of different racial groups living in homes with two or more adult generations. From Pew Research Center.¹⁸

By 2021, a survey taken by Generations United during the pandemic found that one in four Americans were living in a household with three or more generations, and that multigenerational living has nearly quadrupled in the past decade. Much of that surge can be attributed to the economic pressures of the pandemic: nearly six in ten of those surveyed say they doubled or tripled up with family members due to a change in economic circumstances caused by the pandemic. Perhaps most interesting though, 72 percent of respondents say they plan to continue living in multigenerational households for the long term, citing benefits that include enhanced family bonds, greater ease of meeting care needs

of family members, improved mental and/or physical health, and improved finances or more time to continue school or job training.

These results point to the gaps in care, resources, financial and emotional security that have developed as we have become segregated by age, even as our society becomes more age diverse. We have gained additional years of life, but along the way have lost opportunities to share wisdom, joy, and everyday moments. Unless we intentionally foster intergenerational connections and partnerships, we are leaving on the table social capital that humans have never had before. Rather than dwelling so anxiously on the costs of a misnamed "aging" society, through the lens of longevity we can reframe the conversation around measuring and reaping the remarkable dividends of a society that is, in fact, age diverse. Making the most of this unprecedented opportunity is more than an exercise in semantics; myths breed ageism and misguided policies, and intergenerational partnerships are integral to longevity. In a world where 100-year lives will become common, it's imperative that we foster meaningful and supportive connections among different generations as a cornerstone of longevity-ready society. It's time to knit the generations back together again.

CHAPTER 3 | Places and Spaces for Thriving

The communities we live in today were designed at the turn of the 20th century to accommodate young families, at a time when living to old age was a rarity. In much of the United States, the family farm was the most typical residence. It served as an autonomous unit of production and considerable space was required for animals and crops, in addition to parents, children, and often orphaned cousins. In 1900, there may have been one surviving grandparent in the household, but only four percent of the entire population was over 65.

As time passed and people born and raised on farms were lured to cities for higher-paying work, suburbs emerged. Communities built for nuclear families, with houses and lots that offered space for many children and ensured family privacy. Those first suburban dwellers are now elderly grandparents, whose own children moved away and raised families of their own. Having launched the next generation from the home, they find themselves living in spaces that have become ill-suited to their needs and ultimately difficult to manage. Especially in rural areas, isolation can become unbearable when people live at great distances from services and social life. Without public transportation, driving is the only option, and when driving becomes impossible, physical and social isolation follow. Even basic food and health services may be hundreds of miles away. In a world increasingly embedded in virtual connectivity, broadband access remains unavailable in large parts of the country, meaning no online grocery services or telehealth visits.

Each of these models of communities was established to meet the needs and demography

of the times. The needs and demographics of our time call for communities that are longevity-ready, resilient to climate change, connected to the internet, with housing and neighborhoods designed to bring generations together for mutual benefit, rather than continuing to segregate us by age.

Today, a community designed for longevity might look a lot like Fruitvale Village, a cluster of vibrantly painted stucco buildings in a low-income neighborhood of East Oakland. Adjacent to the Bay Area Rapid Transit (BART) Fruitvale station and city bus lines, the complex was designed and built in the early 2000s by The Unity Council, a local community development organization, to revitalize the once blighted area. The ground level of the complex is occupied by retail and restaurants, with social service agencies and offices on the second floor, and subsidized apartments on the third. The buildings are linked by landscaped walkways, and in the center is a tiled plaza with a fountain, all ringed by palm trees, creating a welcoming place to gather for residents or commuters who stop for a bite at one of the local restaurants near the station.

The main building houses a senior center offering free classes, social gatherings, and hot lunches, and down the hall is a charter high school specializing in college readiness and community activism for first-generation students. Downstairs is a Head Start child development center. The proximity of the senior center, high school and preschool create opportunities for spontaneous, daily interaction among generations, much as a traditional Latin American town square does.

On the back side of the block-long complex is a

public library offering free internet access and Oakland's largest Spanish-language reading collection, allowing generations with diverse interests to be served in the same space. On the corner is La Clínica, a community clinic offering free or low-cost healthcare by providers who speak the multiple languages used by their clients.

Also within walking distance is a subsidized apartment building for seniors, its fences draped with fuchsia bougainvillea blossoms. For older residents who love to garden, there are waist-high container gardens spilling over with herbs, flowers, and vegetables. Across the street is Casa Arabella, a new complex of below-market rental apartments for low-income families and formerly homeless veterans, offering supportive services onsite. The contemporary-style orange and white complex wraps around its own courtyard, featuring a brightly painted climbing structure with rope bridges, more container gardens, and benches where residents can relax while kids play. A series of ramps between floors provide not only an attractive design feature and accessibility for older and disabled residents, but also for parents pushing strollers. Birdhouses with bright Latin American designs are mounted outside the windows, a finishing touch by the local architect who designed the complex.

Fruitvale Village is home to working class Latino families; many are immigrants from Central America. The community is far from affluent, yet it is rich in many of the features that contribute to longevity— it is walkable, connected, and affordable, with easy access to public transit and cheerful public spaces with elements designed to foster community, culture, and spontaneous intergenerational contact. Before the pandemic, Fruitvale Village hosted festivals on popular holidays, Cinco de Mayo in the spring and Día de los Muertos in the fall, attended by tens of thousands of visitors. When Covid struck, local restaurants shifted to packaging thousands of hot

meals each day and distributing them for free, with funding from the nonprofit World Central Kitchen. Restaurant workers were able to keep their jobs and residents hit hard by unemployment or illness received free, nutritious meals. "People in this community are dealing with a lot of adversity, but they are doing it together instead of in isolation", says Chris Iglesias, CEO of the Unity Council, the community development agency that built and manages the complex. "No matter how bad things get, people here know that someone always has their back."

Intentional communities for the non-wealthy are exceedingly rare in the United States – Iglesias says more than 4,000 applicants entered the lottery for the 94 apartments at Casa Arabella when they came on the rental market in 2019—and the demand for affordable longevity-ready living spaces that work well for multiple generations will continue to soar in the coming decades, not only in the high-cost Bay Area, but in communities across the country.

Fruitvale Village is not only a microcosm of what a longevity-ready society might look like, it is also a testament to the benefits of persistent and strategic planning. The site was originally intended to become a parking garage for BART commuters, according to the transit agency's plan in 1995. When local activists and businesses objected, the Unity Council held a series of community meetings and negotiated with local officials to come up with a design that would instead prioritize economic development and housing for the then blighted neighborhood. It took a decade of design, development and negotiating for funds from local, state and federal agencies before the complex opened in 2004.

Too often, planning is designed to solve the problems of the moment, or even the past, rather than to anticipate the challenges of the future. While a parking garage may have been a logical

response to the needs of commuters 25 years ago, it took vision to create a solution that delivers benefits, and produces far more revenue, for an entire community. Fruitvale Village was built to create economic opportunity; the multigenerational partnerships that emerged are a collateral benefit, as are the strong social bonds that have helped a community weather economic hardship, racial discrimination, and a pandemic.



The U.S. is in need of a wide range of solutions on a national scale that are feasible not only in cities, but also in suburbs and rural areas.

While small in scale, Fruitvale Village shows that it is not only possible, but imperative, to plan and solve for more than one challenge at the same time. The moment demands that we recover from the pandemic and address the longstanding racial and economic disparities it deepened, so that we become a more equitable and more resilient society. The future demands that we incorporate two additional epochal challenges: the changing climate and the advent of 100-year lives. This is not to assert that full-scale planned communities are the desired response or the only model worth considering as we explore ways to create more built environments that support longevity. The U.S. is in need of a wide range of solutions on a national scale that are feasible not only in cities, but also in suburbs and rural areas. While it may be most cost-effective in cities to examine and change zoning policies to create more multi-generational housing, or places for onsite caregivers to live, in a rural area the greater need might be for access to telemedicine via better broadband, or transportation options for adults no longer able to drive. We have to develop and apply the right solutions in the right places,

otherwise we risk the 2050 equivalent of parking garages in place of longevity-ready communities that we need to start planning for today.

The scale and diversity of the planning is enormous. Designing, experimenting, and transforming existing places or building new ones, and funding it all, cannot be the responsibility of local, state and national governments alone, nor of the private sector. It will take resources from all sectors, including public-private partnerships to promote efficiencies, and above all, a collaborative approach to developing and sharing best practices for all kinds of communities and the people who live and work in them.

In Los Angeles, for example, the Wallis Annenberg GenSpace, a new intergenerational community space in L.A.'s Koreatown, conducted a series of focus groups to learn what kind of programming and resources older residents in this extraordinarily diverse neighborhood would most like to have. Based on community input, GenSpace offers online programming in English and Spanish, and plans to offer additional language options in-person at its vibrant, modern space in the new Audrey Irmas Pavilion at the historic Wilshire Boulevard Temple. Designed by world-renowned architect Rem Koolhaas and lead partner Shohei Shigematsu with age-friendly features, GenSpace will offer programming, events, and classes including technology, art, horticultural therapy, fitness, and nutrition.

One key finding from GenSpace's focus group research is how much older adults said they value connecting with younger people. As a result, the GenSpace team designed a program in creative expression through storytelling, pairing older adults with high school students for guided conversations to share their life stories, an experience that delivers multidimensional benefits. "We see ourselves as more of a social laboratory than a conventional senior center," says

GenSpace Director Dr. Jennifer Wong. “We really want to shake up what’s been done and change the narrative around aging and longevity.”



This whole of life approach is the essence of designing for longevity, and optimizing the built environments in which we spend those longer lives is of paramount importance.

To scale initiatives like this and offer them in a variety of communities, we need strategic vision, and we must think big. We can target public and private investments to not only repair and upgrade outdated infrastructure, but at the same time, to plan comprehensively for a future that creates healthier conditions and greater economic opportunity for all. We become longevity-ready with approaches that benefit people over the course of their entire lives, and not only in old age.

This whole of life approach is the essence of designing for longevity, and optimizing the built environments in which we spend those longer lives is of paramount importance. Far more than the genes we inherit, it is the physical environment in the places children grow up and adults grow old that set the trajectory for the quality and length of our lives. Whether air and water are clean or toxic, or housing has lead in pipes or paint, whether fresh, nutritious food is available or there are safe places to play and exercise outdoors, whether a neighborhood offers quality schools, economic opportunities, access to healthcare, and other needed social supports, are all critical determinants of longevity.

The impacts of the physical environment begin before birth, with advantages and disadvantages accumulating over the entire course of life. This is especially true for Americans living in poverty,

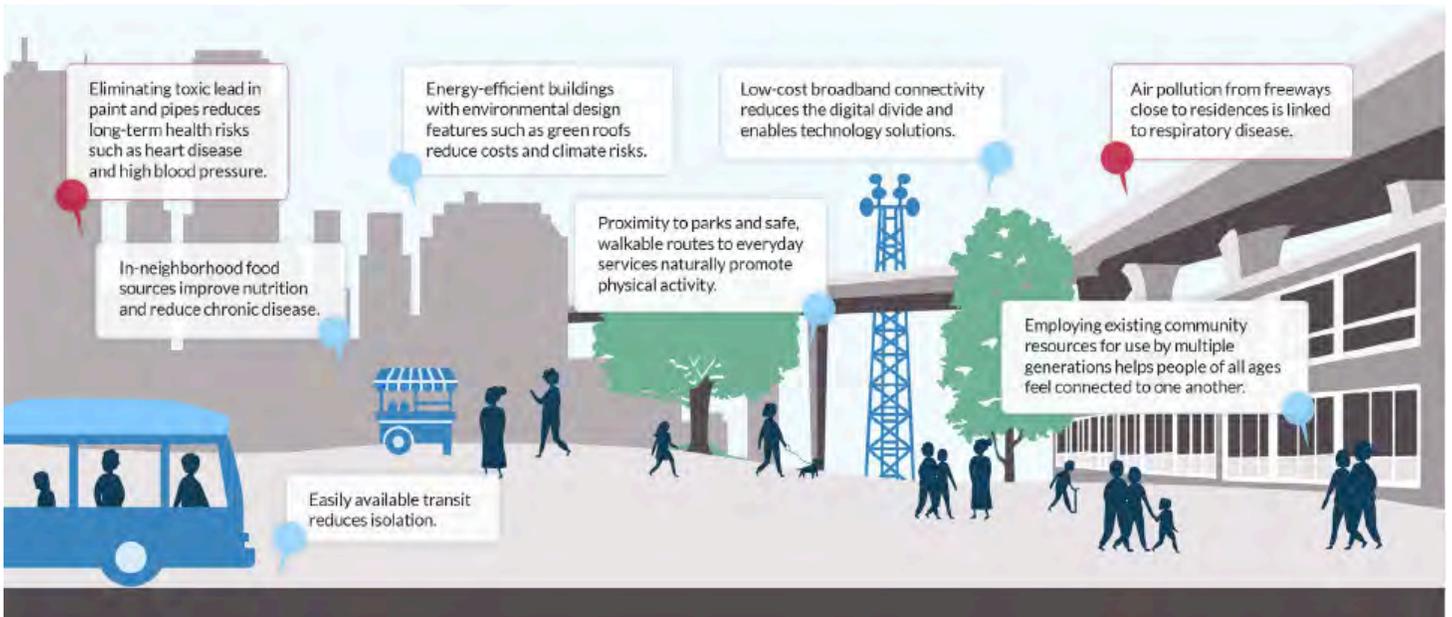
who experience significant disparities in life expectancy that can be traced directly to the conditions where they live.

Life expectancy for a child born in some counties in South Dakota or Kentucky can be up to 20.1 years less than that of a child born in a more affluent county in New York, Colorado, or California.¹⁹ Even within the same U.S. cities, life spans vary significantly. In New York City, for example, children who live just ten miles from one another can anticipate differences of five years in life expectancy.²⁰ Across the entire U.S., men with the highest income live on average 15 years longer than those who earn the least, and women at the top of the income scale live 10 years longer than those at the bottom.²¹ These gaps within even narrow geographical ranges underscore the importance of the environment on mental and physical health, productivity and earning potential. Economists use the term “spatial disparity” to describe the widening gaps in economic opportunity that exist between different places, and the same concept applies to the entire range of environmental factors that determine longevity.

The homes and neighborhoods where we live shape our lives in myriad ways, and the impacts cannot be overstated. Built environments encompass risk factors and potential benefits starting in childhood, including how likely an individual is to be physically active, whether they are isolated or socially engaged, how likely they are to develop respiratory, cardiovascular, or neurodegenerative disease, and even impaired cognitive development. The graphic below illustrates the breadth of impact that built-environment choices can have on life at all ages.

While it is common to attribute healthier outcomes to lifestyle choices and qualities such as willpower and self-discipline, the physical environments in which so many impoverished

Built-environment choices can improve long lives



children—and adults—live remove many of the individual choices and decisions that are taken for granted in more affluent communities.

These impacts become even more troubling given how early in life the physical environment can set the trajectory, and how the impacts cascade. Research shows that lack of regular access to green space can slow a child’s cognitive development by up to 12 months. Access to green spaces also corresponds with beneficial behaviors such as exercise routines and social interaction, while lack of access corresponds to health outcomes that include cardiovascular and respiratory diseases, impaired brain and nerve functioning, obesity, stress, and increased BMI.^{23,24,25}

The deeper effects of the environment may be evidenced in a study conducted in 2010, where researchers measured and compared the gene expression of a large sample of Americans across the country. Surprisingly, 50 percent of the differentially expressed genes could be attributed

to living in urban versus rural areas, whereas only 5 percent could be attributed to ancestry and gender.²⁶

Because of the pervasive impacts of the built environment on the physical and mental health of children and adults, greater access to green spaces, places for social gathering, safe housing and public transportation are essential features on the New Map of Life. Interventions at the community level that benefit entire populations are far more beneficial, cost-effective, and conducive to longevity than social, educational, and medical interventions for individuals with obesity, stress-related diseases, and greater mental health needs.

The baseline for many of these features is low. Only ten percent of the 500 largest cities in the U.S. are rated as “very walkable,” meaning most errands can be accomplished on foot,²⁷ and just 30 percent of U.S. residents have access to a nearby green space and the myriad benefits associated with it.²⁸

Risks are increasingly driven by a rapidly changing climate in the form of extreme heat, drought, wildfires, ever more severe hurricanes, and other weather events that, like the pandemic, cause disproportionate harm to the most vulnerable populations. Building for longevity and mitigating the effects of climate change are deeply interconnected solutions.

Green spaces can be designed to incorporate water and water-related features such as rivers, lakes, wetlands, irrigation systems, and rain gardens in cities, often referred to as green and blue infrastructure.²⁹ These elements are not only effective in reducing heat stress, air pollution, and noise, but reduce the risk of high stormwater runoff and urban flooding, while also enhancing mental health and well-being at all ages.³⁰ Green roofs, green walls, and green façades provide nature-based solutions in many cities, which use vegetation on rooftops or walls to improve both outdoor and indoor thermal comfort and reduce building energy consumption and carbon emissions.^{31,32}

While zoning and planning decisions are up to local governments, state and federal policies can incentivize the development of climate resistant, livable, walkable communities that promote well-being and safety of people of all ages. While the upfront costs of energy efficient construction and green-blue design may in some instances be higher than conventional methods, there are multiple returns on investment that make such design and construction cost-effective over time, whether measured in energy consumption, maintenance costs, controlling insurance costs through greater resilience against catastrophic weather events and controlling insurance costs, or in the well-being and lower healthcare costs of residents of all ages.

As a nation, we must start now to make decisions and investments , to design spaces and places that

are longevity-ready, just as the planners of Fruitvale Village envisioned a vibrant, diverse, economically independent community in place of a parking garage, and took action to transform their vision from the drawing board to the streets of East Oakland. Unlike the genes we inherit, transforming our built environment into one that is longevity-ready is within our control in more ways than we let ourselves believe.

CHAPTER 4 | Extending Health Spans over Longer Lives

A few years before the pandemic, Dr. Mike Snyder was on a flight to Norway when his smartwatch alerted him that his heart rate was elevated and his blood oxygen level was low. A wearable technology enthusiast who leads Stanford's Center for Genomics and Personalized Medicine, Snyder wears four devices simultaneously that monitor dozens of metabolic functions, and when his heart rate did not return to normal after landing, Snyder began to suspect he was showing an early symptom of Lyme disease, which he could have contracted during a recent visit to rural Massachusetts. A visit to a Norwegian doctor and lab tests soon confirmed his diagnosis, and with the right antibiotics, Snyder was able to continue his trip to the Arctic Circle. Had he not been able to diagnose himself with an alert from his smart watch, Snyder could have developed debilitating symptoms far from medical care.

Of course, as a professor of genetics at Stanford, Snyder's ability to interpret data fluctuations are well beyond those of the average step-counter, yet the potential applications for precision personalized medicine are easily apparent. "No one drives a car without a dashboard," says Snyder. "Why would you run around without a health monitor for your body?"

Already, smartwatch apps can detect if a wearer has been exposed to COVID-19, potentially alerting them to monitor for symptoms and self-isolate. In addition to reducing the spread of infectious diseases, AI-enabled technologies may someday allow doctors and patients alike to continuously monitor chronic conditions to detect, and even prevent, the onset of disease.



Bringing health and life spans into sync presents one of the greatest challenges –and the most exciting opportunities– we face in the era of longevity.

Precision personalized medicine is one of several exciting advances that will allow us to extend health spans, the years in which people remain healthy, mobile, mentally sharp, and free of pain as they age. While median life spans have increased dramatically over the past century, health spans have not kept pace, meaning that for many people their most advanced years are still defined by illness and degenerative conditions that their aging organs and tissues cannot seem to defend against. There is mounting evidence that aging does not have to be accompanied by disease and loss of function.

Bringing health and life spans into sync presents one of the greatest challenges –and the most exciting opportunities– we face in the era of longevity.

Neurologist Tom Rando, former deputy director of the Stanford Center on Longevity, started his breakthrough work with a simple question: Would it be possible to reprogram the age of a cell the way we reprogram a computer? In 2004, Rando and his research team designed a series of experiments using a procedure called parabiosis, which involves surgically joining two organisms so that they share circulatory and other systems, much as conjoined twins might at birth, and studying how the shared systems affect each organism. First developed in the 1800s, parabiosis

has been used to test for components of the blood that might influence the physiology of cells and tissues, and has had applications for the study of obesity and immune responses, among other areas.

Rando and his colleagues used parabiosis to pair young mice with old mice to see how the components of shared blood influence the aging of cells and tissues. Within weeks, the older conjoined mouse of each pair began appearing younger and becoming more active, much like its younger counterpart, as a result of its aged cells being exposed to factors in young blood. “That was the ‘Aha’ moment,” says Rando. “This was our first indication that aging, or some aspects of it, could be reversed, which was very different from previous studies showing that drugs or diet could appear only to slow the rate of aging, not reverse the process. The findings that we were observing really looked like rejuvenation!” While blood transfusions are not likely a viable solution for aging humans, the work has led to a search for the components within young blood that create the effect. Were these successfully isolated, they could be a powerful therapeutic for aging cells.

The success of the experiment drove Rando’s interest in the emerging field of geroscience, which seeks to identify –and “reprogram”– the genetic, molecular, and cellular mechanisms that make age the dominant risk factor for certain diseases and degenerative conditions, and to identify new avenues for prevention and treatment. Rather than treating disease or conditions related to age as medicine does now, geroscience offers advanced interventions at the cellular or genetic level that can slow, stop, or even reverse processes that drive age-related diseases, including many forms of cancer, hypertension, diabetes, Alzheimer’s and other forms of dementia, and degenerative conditions such as arthritis, osteopenia, sarcopenia, and frailty.

While immortality and longevity are often conflated in the public’s imagination, Rando cautions that there is no way to *stop* the process of aging, whether in humans or any other species; there is, however, strong evidence that the aging process is *malleable*. One result is healthy aging, as opposed to aging accompanied by disease and decline. Genetics, diet, and lifestyle are of course critical factors as well, but Rando’s work is focused on ways to decouple the mechanism of aging from the diseases and degenerative conditions that it seems to trigger within cells and tissues. “The geroscience promise is that we can tap into biology and translate it into healthier lives through this emerging concept of reprogramming cells so that individuals don’t develop diseases that we associate with aging,” he says. “We aren’t talking about living forever, but we are pushing real scientific boundaries. It is reasonable to expect that people will be able to live into their hundreds, functionally healthy and free of disease.”

Geroscience represents one of the most exciting game-changers in the history of biology, and geroscience therapeutics that can extend health spans will be able to deliver the promise of healthy aging to more of the population. The full promise of geroscience can only be realized though, if this individualized approach to therapies is complemented by a much-expanded investment in population-level delivery of prevention and health promotion by public health and the public health system. Otherwise, the discoveries to come through geroscience will widen health disparities, excluding those who cannot pay.

Rando predicts geroscience therapeutics will become a mainstay of preventive medicine in the decades ahead, a profound shift to the disease-centered model of medicine, which assumes that as people age, they will develop diseases related to aging that will then need to be treated.



Geroscience offers a new paradigm by seeking to understand which aspects of aging are most responsive to prevention and intervention, and then applying that information to develop therapies that prevent the onset of disease. In essence, it holds the promise of hacking the aging process at the cellular level.

A patient may recover from one age-related disease, only to suffer in time from another, subjecting them to rounds of medical whack-a-mole, that diminish overall health and resilience along the way, and require increasingly extensive interventions that too often produce additional suffering and discouraging outcomes, all at tremendous expense.

Geroscience offers a new paradigm by seeking to understand which aspects of aging are most responsive to prevention and intervention, and then applying that information to develop therapies that prevent the onset of disease, rather than treating illness after it emerges. In essence, it holds the promise of hacking the aging process at the cellular level.

In addition to parabiosis, one promising area of exploration is in therapies for suppressing the inflammatory response that aging cells tend to leave in the “on” position. For example, rapamycin, a drug first approved to prevent organ rejection in transplant patients, has been shown to enhance longevity in mice by suppressing the protein that appears to regulate aging. Mice treated with doses of rapamycin showed longer life spans than average and signs of delayed aging with later onset and prevalence of age-related diseases. A growing number of animal and human studies suggest that rapamycin in adjusted doses can also lower the risk of cancer, Alzheimer’s, Parkinson’s

disease, Type 2 diabetes, osteoporosis, and macular degeneration.

Another class of drugs known as senolytics, goes after “zombie” cells in aging animals that stop dividing, but refuse to die. These senescent cells secrete molecules called cytokines, growth factors, and proteases that affect cells nearby and incite local inflammation, and are linked to osteoarthritis, which causes inflammation in aging joints, and atherosclerosis, the hardening and narrowing of arteries that occurs with age. Caloric restriction is another therapeutic approach shown to extend lives in laboratory mice, and works by ratcheting metabolism up or down, depending on the availability of food. Energy resources in the body make tradeoffs between growth and reproduction or repair and maintenance. In times of famine, fertility is turned off to redirect cells to focus on survival and cell maintenance. Since aging results from unrepaired damage to cells, this enhanced maintenance serves to slow down the aging process.

We will age and we will still die, but the chances are greatly improved for aging in a healthier, more active state, and experiencing death without undue *suffering*. The result can be an end-of-life scenario in which decline is compressed into a short period that occurs later in life, without pain, allowing more people to enjoy continued health, mobility, and mental acuity well into their 80s, 90s, and beyond. “We can better come to terms with death when we feel more confident about our chances for a long, satisfying and high-quality life, without suffering or a loss of dignity,” says Stanford Center on Longevity founding director Laura Carstensen. “People could prepare for the end of their lives with more control.”

This scenario has significant impacts not only on the quality of life for older people and their families, but also on the projected costs of healthcare and caregiving associated with longer

lives. By extending health spans with new therapeutics, geroscience holds the promise of transforming the experience of aging, and significantly bending the cost curves. Advances in geroscience will bring greater opportunities for healthy aging, transforming old age from a life stage now associated with illness, frailty, and dependence into an additional life stage filled with the potential for vitality, independence, and continued contributions to society.

Health care, including therapeutics made possible by geroscience, is one avenue by which to extend health spans. While medical therapeutics from geroscience are still years from the market, there are other critical steps we can take now to successfully increase health spans, such as expanding and modernizing public health across the course of 100-year lives to create healthy conditions for everyone.

A key principle of the New Map of Life is that healthy aging requires investments in health at every life stage. This process begins in childhood, when access to healthcare services from newborn screening to childhood vaccinations, and programs to provide adequate nutrition are essential to ensure that children are launched on a healthy trajectory for life.

Two of the leading causes of premature death in adolescence and early adulthood are suicide and substance abuse,³³ highlighting the need for access to mental health and substance abuse services for all. In midlife, timely identification and management of risk factors for chronic medical conditions is essential, which means people need access to reliable healthcare services, regardless of their employment status. Yet, too often, those facing health challenges are forced to leave the workplace prematurely, costing them not only lost income, but access to employer-funded health insurance, and all but guaranteeing poorer health outcomes.

By midlife, people need to sustain functionality and reduce the odds of disease, factors that are determined not only by genetics and environment, but also by lifestyle and diet. While each life stage presents unique needs and challenges for the healthcare system, the trajectory is set early in life, and must be maintained and enhanced at each stage along the way. Swooping in during old age with a new exercise routine, diet, or a miraculous medical intervention is unlikely to flip on the good health switch in an older person; good health in old age results from the accumulation of health factors over the entire life course. This is not to suggest that interventions and behavioral changes won't help smooth the journey of aging, rather that interventions taken early in life allow benefits to accumulate for decades.

A clearer awareness of health span can also contribute to a cultural shift around dying, giving people more control over the end-of-life care they receive. When their health span can no longer be reasonably extended, many older or terminally ill people may choose palliative care over spending their final days or weeks in a hospital intensive care unit, thus avoiding the suffering and expense that are so often incurred. A longevity-ready society also offers scenarios for dignified and comfortable death at a much lower cost to society.

A second major challenge is closing the health opportunity gap that starts in childhood and is driven by poverty and exposure to childhood trauma, including racism, environmental hazards, and other social determinants of health. These factors can create the stress responses that trigger inflammation, which can lead to chronic, life-shortening diseases including hypertension, asthma, and diabetes, that are found disproportionately in people of color. While mountains of evidence show that lifestyle factors such as eating well, exercising, reducing stress

and getting enough sleep correlate with better health, a child who grows up in a food desert, without access to green space or healthy places to play, and who is exposed to chronic trauma does not have the opportunity to make “healthy choices.” The same is true for the adults caring for that child. Addressing health disparities means addressing the systems that produce them, and investing not only in better access to healthcare, but investing in the health of all communities, especially those affected by poverty, discrimination, and environmental damage.

The premise of the New Map of Life is to identify interventions and investments that are needed now if we are to optimize the promise of longevity equally for all people. This is an urgent challenge in light of the disparities that set different groups of Americans on sharply different trajectories predetermined in large part by race and socioeconomic status. “The goal is not to advocate for extending human life for the sake of living longer, but to assess how we can make these longer lives we have been given better, healthier, and more productive,” says SCL Director Laura Carstensen. “How can we apply science, technology, and public policies to make the benefits of longevity more widely and equally available?”

Three of the most promising approaches to the challenges of promoting healthy longevity are considered below.

Health Span as an Emerging Public Health Tool

A complex healthcare system serving a diverse and large population demands a more nuanced means of measuring public health than life expectancy. One-size-fits-all, retrospective measurements do not adequately capture the complex interplay of factors that influence a person’s health trajectory, including their mental health, access to employment, and their social

connectedness, all of which will vary, based on demographic factors. In this context, health span is a novel public health measurement that reflects the complexity and nuance of factors that contribute to longevity.

Defined as “the period of life spent in good health, free from the chronic diseases and disabilities of aging,”³⁴ health span captures the quality of life in ways that life span cannot, by measuring multiple dimensions of wellness. Social determinants of health such as housing and food security, employment, financial security, and social engagement also factor in. In this way, health span measurement serves as a positive complement to the “compression of morbidity” hypothesis,³⁵ which targets public health interventions to reduce the duration and burden of medical infirmity toward the end of life.³⁶

Expanding the Role of Telemedicine in the U.S. Healthcare System

Digital technologies have already transformed medicine. With the advent of electronic medical record systems, digitization of medical imaging, and development of robotic-assisted surgery, the field of medicine has already undergone fundamental changes in how healthcare is delivered. The next great wave of innovation will come as telemedicine, defined as a suite of services for providing healthcare outside of the traditional hospital or clinic setting, becomes routine. COVID-19 dramatically accelerated this development, prompting a sweeping uptake of telemedicine services nationwide, accompanied by growing acceptance of telemedicine, with patients even reporting a preference for virtual services.

- **Virtual visits:** Including healthcare services administered via synchronous, audio-visual video, or telephone conferencing modalities (i.e., Zoom, WebEx, Doximity App, FaceTime). Allows for multiparty conferences to connect

the patient and provider, as well as relevant additional parties such as family members, medical interpreters, medical trainees, and ancillary healthcare staff.

- **Specialty care:** Acute care hospitals, particularly in rural areas, have benefited from remotely consulting specialty services typically only available at referral centers. Telestroke (or stroke telemedicine) serves as a model example: hospitals supplement available neurologic resources with a telestroke tool, whereby a neurologist at a referral center can guide acute stroke management, allowing for safe administration of urgent stroke therapies and timely transfer to a higher level of care.³⁸
- **Specialist interpretation:** Remote interpretation of digital radiology,³⁹ digital pathology,⁴⁰ and electrocardiograms (ECGs) in myocardial infarction⁴¹ have all been described, leveraging the scope of practice of specialty physicians to better serve a larger catchment area, and allowing for early triage of time-sensitive conditions.
- **Health dashboards:** Healthcare systems are increasingly integrating with smartphone applications and web-based products to offer patients health dashboards where patients can access their medical chart including their appointment schedule, medical results, and physician notes. Advanced dashboards allow patients to cancel or reschedule appointments, and send electronic messages to their provider teams.

Smart devices: A wide array of devices have come to market over the last decade for health and fitness monitoring: wearable devices track steps, monitor heart rate, and record sleeping patterns; contactless devices record vital signs in the home setting; and smartphone apps integrate with smart devices to report data trends.

As telemedicine services proliferate, they grow in popularity and uptake. Studies of telemedicine before COVID-19 have already shown these services to be feasible, clinically effective, and well-received by patients seeking treatment for a range of needs, including chronic condition management, smoking cessation, and telepsychiatry services. Given the rapid advancement of health technologies, and growing penetration of technology into the homes and lives of average Americans, it stands to reason that the efficacy and cost-efficiency of telemedicine will only improve, as insurance companies develop new reimbursement structures that favor telehealth services. There are also new risks. The pandemic magnified the urgency of closing the digital divide as a matter of public health and a tool for educational and economic advancement. With the widespread closure of schools, libraries, and coffee shops, previously accessible public internet access points were no longer available, leaving millions of American school-age children without access to broadband in their homes during the pandemic, and millions more living in neighborhoods lack the required infrastructure for broadband at all. The effects of the digital divide have never been more acutely felt, when access to essential services such as healthcare and education hinge on home or mobile access to the internet.

Telemedicine and Health Span: A Role for Artificial Intelligence

Electronic health data is now being recorded and stored on a scale never seen before: public health offices track and monitor incidences of disease, electronic medical record systems store troves of patient data, and smart devices monitor individual-level biometrics and activity level with tremendous granularity.

Advances in artificial intelligence and deep neural networks mean that the interpretation of these vast troves of data is within reach. A digitized

health span tool can be equipped to consolidate and interpret disparate sources of information to recognize trends and offer predictive analytics based on population characteristics. Such a technological breakthrough will greatly empower policymakers and public health experts to more effectively assess health span in real time and influence the health trajectory of our populations.

The last major variable to consider is the role of lifestyle and fitness. In the full context of 100-year lives, lifestyle behavior modifications have the potential to create meaningful, enriching years with increased well-being and resilience. Physical activity, nutrition, sleep, stress management, social connection, substance use, screen time, work behaviors, and access to preventative healthcare are all factors that impact well-being throughout the life course. These behaviors not only have the potential to impact one another, they also are affected by race, socioeconomic status, and other variables, giving rise to an unlimited number of lifestyle paths people can take starting in early childhood and progressing into early adulthood, midlife, and older adulthood.

Outdoor play and connection to nature in early childhood are associated with the development of autonomy and independence whereas television viewing time is associated with the development of obesity and increased risk of cardiovascular disease later in life.^{43,44} Simple interventions such as more time for recess and creating opportunities for children to safely walk or ride their bikes to school can influence lifestyle habits from a young age.

As children advance into the adolescent years, screen time and social media impact self-esteem and self-efficacy with broad impacts.⁴⁵ As adolescents transition into young adults and working age adults, substance use and stress become key considerations. Alcohol consumption

and smoking at later ages are tied to substance use at younger ages and stress plays a role in determining quality of life.⁴⁶ Physical activity in this age group is tied to resiliency in later years as well as the reduction in sarcopenia and osteopenia.^{47,48} Workplace-based interventions in this age group focused on technological advances can help target physical activity and stress, setting up increased well-being in the later years.

Sedentary children become sedentary adults, and sedentary behavior limits longevity. Along with sedentary behavior, obesity rates are affected by eating habits, nutrition quality, and food access that impact health starting at a young age. The trajectory for longevity is set early in life by a complex interplay of genetics, biology, behavior, and environment. While age remains the single biggest risk factor for many diseases, and although geroscience offers a way to crack the code and decouple aging from disease, it is only one of the tools available to promote longevity. The other tools are available now and demand that we start making changes in public health, healthcare, lifestyle, and fitness and applying technology at the individual and community level to put more people on a path to healthy aging. Adding life to the years is as important, if not more, than adding years to lives.

Part II: Learning and Earning

CHAPTER 5 | Setting the Course through Creativity, Play, and Discovery

In the U.S. and other wealthy nations, demographers expect that half of today's five-year-olds can live to the age of 100.⁴⁹ Think about that from the perspective of a classroom of new kindergarteners who will be expected to sit in their chairs without squirming, to start reading before they lose their first tooth, and who will spend more of their lives in front of screens than any generation in human history, on their way to becoming adults considered productive and successful.

What if these future centenarians were instead encouraged to spend the first years of their long lives drawing on the sidewalk, hanging from monkey bars, turning over rocks and counting the snails beneath them, not as rewards granted during recess, but in fulfilling an essential purpose of childhood? What might happen if we discarded the cultural script that has transformed childhood into a launch pad for blasting off to future achievement, and replaced it with a vision of the years from birth to kindergarten as a unique and vital developmental phase for play, exploration, and unbridled creation? Would the world run out of successful future adults? Or would it be full of happier and more creative people?

Longevity is often misunderstood to be another word for aging (the process) or for old age (the life stage). It is neither. Longevity is defined as the "great duration of life." In our view, the potential lies in where and how to spend the extra 30 years of life

we have been given, so that we can be healthier, more productive, engaged, and joyful at every stage. Rather than landing on a bright dot labeled "successful old age," the New Map of Life offers design options for more rewarding journeys *throughout* life, starting with children who are healthy, happy, and engaged from the start. Through this lens, learning to read by five may be less of an imperative than learning to love learning if a child is to make the most of the 95 years that potentially lie ahead.

We can start the journey by taking our foot off the gas, and appreciating that early childhood is an optimal period of life for giving kids time and space to explore, improvise, and create. Children are primed to discover their worlds in this way during the pivotal years between birth and kindergarten, when they acquire the cognitive, emotional, and social skills needed for a healthy, happy, and long life. Creating opportunities for that messy and indirect process to unfold, rather than pressuring the youngest children into becoming small facsimiles of older learners, not only makes childhood better, it lays the foundation for a lifetime of learning, collaboration, and productivity.

As people live longer and the roles and social norms associated with age become more fluid and less uniform, more self-defined and less regimented, qualities such as resilience, self-efficacy (a belief in one's own abilities to shape outcomes), and curiosity rather than dread when confronted with change will become the

emotional toolkit for longevity. These traits are innate to some degree, but also learned. People who acquire them in early childhood have more time to practice and hone them during adolescence and early adulthood, and are better equipped to navigate the challenging passages during midlife and older adulthood that are often brought on by illness or disability, job loss or career change, divorce or financial setbacks.

Early childhood is of course not the only window to develop cognitive or coping skills, and the New Map of Life is designed to optimize *every* life stage, by creating more opportunities to change or correct course as needed – and to view such adjustments as inevitable and as indications of resilience, rather than failure. Stanford pediatrician Paul Wise cautions that placing too much emphasis on the unique opportunities of childhood risks making adolescence and the years beyond into a time for “palliative care” rather than a continued source of opportunity for young people to build skills and adjust course. With this in mind, we recognize early childhood as a uniquely *effective* time for setting the compass headings to embrace learning, acquire social skills, and build resilience, traits developed in childhood that will be useful throughout life.

While early childhood is the prime time to set the course for longevity, this is also when the inequities start taking their toll, diverting children from fulfilling their potential based on race, socioeconomic status, or conditions in the neighborhoods where they are born and grow up. Those odds are set even before birth, when the health and environmental conditions of a baby’s mother (and even those of her mother) directly affect a child’s health, resilience, and future ability to learn. In a society where so many children have unequal or limited chances to experience longevity, we have the greatest opportunities –and urgent, collective obligation– to reduce adversity in the first years of life.

Effectively supporting children means also supporting the people who take care of children through policies and investments that promote affordable, high-quality childcare for working parents, universal early childhood education, and reducing child poverty, which enhances a child’s nutrition and health, and their future capacity for learning and earning. Two-generation programs that provide young children with skills to do well in life, and that offer their parents skills and tools for social and economic mobility, are among the most effective and will be examined later in this chapter.

The role of grandparents deserves special consideration for their nurturing roles in the lives of young children. As psychologist Alison Gopnik notes, relative to other species, humans have uncommonly long periods at the beginning and end of life when they are vulnerable and regarded as unproductive, that appear to be evolutionary bookends. “Just as impulsiveness, curiosity, and noise of children might contribute to exploration and compensate for their other inabilities, the older humans’ expertise, patience, and storytelling skills might compensate for loss of speed and strength.” Gopnik writes. Childhood and old age “turn out, biologically, to be the key to many of our most valuable, deeply human capacities. They nurture and facilitate our exploration and creativity, cooperation, coordination and culture, learning and teaching.”

Although young children are not as skilled as older children and adults when it comes to certain cognitive tasks such as focusing attention and avoiding distraction, they are capable of rapid learning about their physical and social worlds. Multiple studies have found that children are capable of outperforming adults on some learning tasks, showing more flexibility and creative thinking.^{50,51} Cartoonist Lynda Barry, who is also a professor of interdisciplinary creativity at the University of Wisconsin at Madison, used her

MacArthur Foundation “genius” grant to study the artistic habits of children and found that “peak creativity” happens at the age of four, when children draw with abandon regardless of their skills, but declines by the age of eight, when children typically stop drawing without being tasked, as they become aware of imperfections and compare themselves to those who are more skilled.

Multiple fields of study have led to the conclusion that investing in early childhood is the most efficient strategy for improving future productivity, economic success, and health, and reducing disparities in our society.⁵²

Addressing Racial Disparities

In the United States, children’s social status, exposure to adverse experiences, physical environment, health, and education are often tied to race. The origins of racial disparities in health and well-being can be traced back even prior to birth. For example, Black women are more than twice as likely as White women to experience food insecurity during pregnancy, increasing their risk of maternal depression, gestational diabetes, infant mortality, and birth defects.^{53,54,55} These factors are associated with disease susceptibility and mental health in children,^{56,57} as well as more rapid physical aging in later life;⁵⁸ further, the effects may predispose multiple generations to metabolic problems implicated in obesity and diabetes. More than 20 percent of Black and Hispanic children are obese, compared to 15 percent of non-Hispanic white children.⁶⁰ Poverty and poor health are related to lower academic achievement.

The Importance of High Quality and Affordable Childcare

High quality childcare helps children develop foundational skills for future success and well-being, but also helps parents pursue adult education, employment, and higher income.⁶¹



The key to optimizing the developmental potential of early childhood, and ultimately the quality of long life, is to build social and physical environments for children that are safe and supportive.

Increasing social mobility for families helps decrease children’s exposure to adverse experiences (e.g., violence, neglect, and family dysfunction). Full-time childcare has also been found to improve math and reading ability, increase the likelihood of graduating from college, and decrease the likelihood of receiving public assistance and coming into contact with the criminal justice system.⁶² Despite these benefits, fewer than half of children the U.S. aged three or younger are currently enrolled in childcare.⁶³

Increasing Emphasis on Academics and Neglecting Physical Activity

Early childhood is also an important time for establishing the healthy behaviors that contribute to disease prevention and that are foundational for lifelong engagement in physical activities.⁶⁴ Current guidelines recommend that young children engage in at least 60 minutes of moderate to vigorous physical activity per day;⁶⁵ nearly half of children do not meet these recommended guidelines.⁶⁶ Physical activity starts to decline as early as the age of school entry,⁶⁷ when children are required to spend more time sitting in a classroom environment. Physical education is also becoming less of a priority for schools. The median physical education budget for elementary schools is only \$460 per school year.⁶⁸

We are increasingly creating environments and daily activities for younger children that are similar to those of their older peers. Preschool environments limit children’s physical activity

and are linked to increased time spent being sedentary, while introducing a growing emphasis on academics in preschool at the expense of free play.⁶⁹ By contrast, children in the first half of the 20th century experienced what some researchers refer to as the “golden age of play,” when unstructured outdoor time was the norm for children, allowing ample time for physical activity, gaining independence and developing collaborative play skills without adult monitoring or intervention.⁷⁰

One potential cost of asking children to “perform” at increasingly younger ages is that it shrinks early childhood as a developmental stage. The key to optimizing the developmental potential of early childhood, and ultimately the quality of long life, is to build social and physical environments for children that are safe and supportive.

These environments should reduce children’s exposure to adverse experiences and physical pollutants, increase the presence of stable, nurturing relationships, and encourage healthy lifestyle habits such as engagement in physical activity. At the same time, these environments should be designed to provide children with time and space to explore, create, and cultivate skills that have been established as critical for well-being across the life span. Effectively creating these new environments will require adopting new practices and policies, philosophical shifts in how we think about and evaluate early childhood,

and a comprehensive, multidimensional approach to supporting children, their families, and the individuals who work with them.

Returns to a Unit Dollar Invested

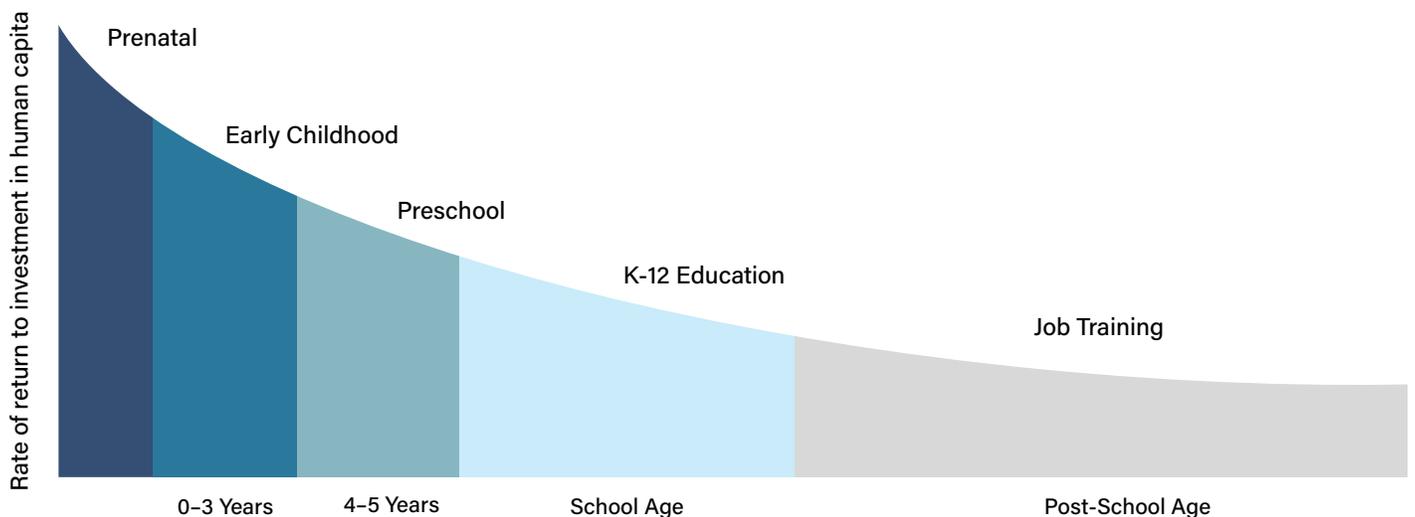


FIGURE 2: Heckman (2008). Economist James Heckman calculated that public investments in comprehensive, high-quality early education and childcare programs deliver a 13 percent annual return on every dollar spent. The rate of return is influenced by two-generation approaches that also benefit working parents of young children.

Economist and Nobel Laureate James Heckman is a pioneering advocate for investing early in early childhood education to develop human potential and promote equity, with strong economic returns defined by the Heckman Equation (see Figure 2). Describing the years from birth to age five as “a critical time to shape productivity,” Heckman writes, “Early childhood education fosters cognitive skills along with attentiveness, motivation, self-control, and sociability— the character skills that turn knowledge into know-how and people into productive citizens.”

Economic models suggest that comprehensive, high-quality early education and childcare programs are excellent public investments, delivering a 13 percent annual return on every dollar spent.⁷¹ Programs that target the earliest years of childhood provide even stronger rates of return to investment in human capital than do programs that start at preschool-ages or later. The financial benefits are, in part, the result of a two-generation effect on education and workforce. High quality childcare helps children develop foundational skills for future success, well-being, and productivity in the workforce, but also helps parents, particularly single mothers, pursue adult education, employment, and higher income.⁷²

There is no single solution for optimizing childhood as a stage in the New Map of Life, but there are multiple approaches to intervention proven to improve children’s health and development for lifelong, intergenerational, and economic benefits. Providing children and families with financial, social, and caregiving support are necessary for building resilience against the negative effects of childhood adversity. We can appreciate the value and enhance the opportunities for intergenerational relationships in the lives of young children, whether the enrichment comes from grandparents or other family members, or members of the community. Wider recognition is needed for early childhood as

a period of great opportunity as well as risk, as are resources devoted to high quality childcare and access to early childhood education, where children develop foundational skills for healthy, happy, and successful longer lives.

CHAPTER 6 | Beyond the Classroom: Learning for Life

Think of a child's inborn drive to explore and learn. Is there a way we can retain that thirst for learning, deploy it inside and outside of classrooms, and have it continue for life? A useful place to start is with the distinction between "learning," the process of acquiring new knowledge, or modifying existing knowledge, behaviors, skills, values or attitudes, and "education," the process of acquiring systematic instruction. Learning and education are often conflated, with education assumed to entail a cognitive task of limited duration, occurring within the confines of the formal institutionalized system. Children enter kindergarten and emerge either after high school or college, by their late teens or early 20s, presumably prepared to enter the workforce.

This educational model may have been adequate for the people it was designed to serve, primarily white males who lived for 60 or 70 years, earned their living in a single primary occupation, and served at most a few employers during their working years. Longevity demands a different and more inclusive approach to developing human potential. Longer lives are less linear and predictable, marked by twists, turns, climbs, and setbacks, with each new stretch likely to require new abilities and skills to remain productive, not only through the many changes produced by age, but also in a global economy that is becoming increasingly automated. If machines can be programmed to continuously learn in the era of artificial intelligence, surely humans must also have opportunities –and be encouraged– to acquire new knowledge over the course of their lives, and to continuously develop the uniquely human skills that machines cannot replicate or replace.

And if all children are to be truly educated for the challenges and opportunities that their longer lives will bring, we must undertake two simultaneous and challenging changes. First, we must at last close the pervasive educational opportunity gaps in the current educational system that prevent so many children from fulfilling their potential due to racial or socioeconomic barriers, such as living in unsafe, unhealthy neighborhoods or attending poorly resourced schools, or being the first in the family to try and attend college. The second is developing new pathways for learning that are less tethered to formal educational institutions, and creating a credentials-based system for skills and abilities that will be recognized by employers and society more broadly.

These opportunity gaps start early and persist, casting a lifelong shadow over income and wealth-building, as well as health and longevity. In the U.S., a college graduate on average lives nine years longer than a person who does not complete high school. In the U.S., gaps in educational attainment track along racial lines. About 44 percent of white adults ages 25-29 in the U.S., and 71% of Asian-American adults, have a bachelor's degree; while the rate is 23 percent for Black adults, 21 percent for Hispanics, 16 percent of Native Americans and 15 percent of Pacific-Islanders.^{73,74}

College graduates lead lives that are not only longer, but healthier as well, especially as they grow older.^{75,76,77} Because earnings increase with education, people who are more highly educated gain access to health-improving resources⁷⁸ and surroundings, and those advantages accrue in the form of longer and healthier lives.⁷⁹

People with higher levels of education are less likely to smoke, to be depressed, to have heart disease, and have high HDL cholesterol – all factors that significantly increase the risk for cardiovascular disease.⁸⁰ They also have better access to psychosocial resources and a stronger sense of self-efficacy and social support, which both reduce the likelihood of depression and offer helpful coping mechanisms for dealing with health setbacks that can come later in life.⁸¹ People with more education are also better prepared to make use of new technologies and to adapt to major life changes, such as a new job or reinventing themselves in retirement.⁸²



Rather than front-loading education into the first two decades of life, the New Map of Life envisions lifelong learning as the norm, with people of all ages able to acquire the knowledge they need at each stage of their lives and to access it in ways that fit their needs, interests, abilities, schedules, and ability to afford it.

Given the strong correlations among education, health, and longevity, the New Map of Life calls for innovation and more flexible options in our current education model so that more people can develop their potential, becoming and remaining productive and engaged over longer lives. New options for learning outside the confines of formal education, combined with social acceptance of this concept, mean that people can bypass the outdated, three-chapter life course of education, work, and retirement, in favor several shorter, more flexible intervals dedicated to learning, working, caregiving, and leisure that can be woven as needed into life's journey. The working intervals are likely to include more than one primary career.

Rather than front-loading education into the first two decades of life, the New Map of Life envisions lifelong learning as the norm, with people of all ages able to acquire the knowledge they need at each stage of their lives and to access it in ways that fit their needs, interests, abilities, schedules, and ability to afford it. Lifelong learning provides not only economic opportunities but also measurable health benefits, especially for older adults. Maintaining stimulating activities improves cognitive and physical health. The state of Georgia, for example, has made tuition free at all state universities and colleges for residents 62 and older, whether senior scholars are enrolling for credit toward a degree or auditing.

It's also time to question some of the core assumptions underlying K-12 education as well as our systems of higher education. Why do we still rely on a school year designed for an agrarian society that needed children in the fields during harvest season and school days that ended early in the afternoons on the presumption that one parent, a mother, would be there to welcome them home? Why do classrooms remain segregated by age rather than ability or developmental stage, during a time of unprecedented age diversity? Why are standardized tests still the leading determinant for student achievement and school funding, when so much evidence shows they perpetuate bias and disadvantage? What are more meaningful and accurate measures of learning? Why is higher education still defined by degrees developed during the Middle Ages, when so many students, parents, and employers today seek different pathways and certifications?

The COVID-19 pandemic turned many long-held assumptions and practices upside down and revealed new possibilities. Since SAT and ACT tests could not be administered during the pandemic, many colleges and universities temporarily dropped application requirements

or submitting scores. Ivy League universities and the University of California system, which made the change permanent, reported the largest and most diverse applicant pools ever seen. Other public university systems were forced to confront the limitations of revenue models that depend on out-of-state and international students paying full tuition and hefty surcharges, and limit access for lower income, in-state students. Community colleges, the unheralded engine of access for many first-generation students, gained new appreciation. Not all of this qualifies as bad news.

Dramatic disruptions took place in K-12 learning as well. With an estimated 90 percent of the world's children unable to attend schools in person, according to the United Nations,⁸³ millions became part of a real-time, global experiment in distance learning. As any glassy-eyed student, exhausted teacher, or stressed parent can attest, this forced innovation was traumatic for many children, families, and educators alike—and it deepened existing disparities terribly. Yet, while the conditions were far from optimal or fair, the pandemic also drove a profound cultural shift in our view of online learning, and this can serve as a forward-thinking prompt to optimize learning technologies for people of all ages.

If high school students were able to perform in virtual musicals and earn community college credits from their bedrooms during the pandemic, it doesn't take much of a leap to envision a future where it is the norm for a student in a rural or tribal community to enroll in an AP class offered by a high school in a nearby city, for a kid in Los Angeles to take Japanese lessons from a teacher in Tokyo, or an older adult to learn Portuguese from a teacher in Lisbon; a future where grandparents and grandchildren can participate in the same online history class, or where a learner of any age can sample yoga, clarinet, or cooking classes from an unlimited online buffet.

The possibilities to extend learning opportunities beyond classroom walls expand even more dramatically through immersive technologies and hybrid learning models that combine classroom time with online resources.

The pandemic also drives home the importance of closing the digital divide as a more palpable and urgent priority than ever. For the fortunate, the pandemic-driven disruptions turned the world into a giant bazaar of MOOCs (Massive Online Open Courses). For millions of children in underserved and rural communities lacking high-speed internet access, and for children from low-income families where adults were unable to work from home and supervise learning, for kids lacking computers or quiet spaces conducive to learning, disadvantages deepened. Children with language barriers or special needs that could not be met online struggled even more, and the overall impacts on the mental health and social emotional learning (SEL).

We have an opportunity to draw a comprehensive and nuanced set of lessons from the experiences of the pandemic and apply them in relevant ways. Both this, and the challenge of becoming a longevity-ready society more broadly, call for a rewrite of our education script at the K-12 level and for higher education.

Stanford's Graduate School of Education and Stanford's Transforming Learning Accelerator convened a yearlong working learners initiative with leading educators to improve educational advancement and economic mobility for adults who are employed and pursuing learning opportunities at the same time. Recognizing that only about one-third of American adults have a four-year college degree and the socioeconomic benefits it confers, the initiative calls for educational institutions, employers and policy makers to collaborate in developing new pathways for learning and credentials for employment for

the majority of American adults who do not have a four-year degree, yet seek career advancement.

The New Map of Life also envisions more and varied pathways for people to access the benefits of lifelong learning and the longevity it promotes. One place to start is with an understanding that lifelong learning is less likely to occur in a classroom or other dedicated educational setting and more likely to involve a screen or immersive technology, and to take place in a home, workplace, or a nontraditional training program.

Postsecondary Interventions

There are also several interventions that aim to improve postsecondary enrollment. Summer counseling is one type of intervention intended to reduce summer “melt,” a phenomenon in which students have been accepted to college but fail to matriculate. These summer counseling services, delivered during the months between high school graduation and college enrollment, involve outreach by college counselors or peer mentors via text messaging campaigns, e-mail, phone, in-person meetings, instant messaging, or social media. These intervention services provide college-intending individuals with information about tasks required for college enrollment, such as taking placement tests, arranging for housing, acquiring medical insurance, obtaining financial aid, and registering for courses. Summer counseling also aims to help students overcome unanticipated financial, informational, and socio-emotional barriers that prevent college enrollment. The evidence suggests that summer counseling had potentially positive effects on credit accumulation and persistence and mixed effects on college access and enrollment for recent high school graduates.⁸⁴

Dual enrollment programs (i.e., dual credit or early college) also aim to boost college access and degree attainment, especially for students typically underrepresented in higher education.

Dual enrollment programs allow high school students to take college courses and earn college credits while still attending high school. Dual enrollment programs support college credit accumulation and degree attainment via at least three mechanisms. First, allowing high school students to experience college-level courses helps them prepare for the social and academic requirements of college while having the additional supports available to high school students. Second, students who accumulate college credits early and consistently are more likely to attain a college degree. Third, many dual enrollment programs offer discounted or free tuition, which reduces the overall cost of college and may increase the number of low socioeconomic status students who can attend and complete college. Research shows that dual enrollment programs had positive effects on students’ degree attainment in college, college access and enrollment, credit accumulation, high school completion, and general academic achievement in high school.⁸⁵

There are also many interventions that target students once they are in college. For example, first year experience courses, often referred to as college success courses or freshman seminars, are courses for first-year students in 2-year and 4-year colleges. The general goals of first year experience courses are to support the academic performance, social development, persistence, and degree completion of college students. Additionally, first year experience courses often aim to increase students’ sense of campus community and connection to their institutions, while giving students the opportunity to interact with faculty and peers. Research shows that first year experience courses had potentially positive effects on credit accumulation, degree attainment, and general academic achievement for freshman college students.⁸⁶

Other interventions use online tools to support

student learning. For example, the Open Learning Initiative (OLI) provides online courses and learning materials to instructors and learners at low or no cost. The interactive OLI courses feature machine-guided instruction, immediate feedback, exploratory virtual laboratories, worked examples, and practice problems. Most OLI courses are open to both independent learners and students in instructor-led courses. OLI provides content that ranges in length from several-hour modules to full-semester courses. Independent learners may complete the material at their own pace, while students in instructor-led courses may be assigned to complete the material in a specified timeframe. Research shows that implementing OLI may increase credit accumulation and persistence but has inconsistent effects on academic achievement.

Interventions in Later Adulthood

As people age, developmental changes affect their learning, including modest changes in short-term memory, speed of learning, and attention. Absent brain diseases, in late adulthood people's ability to reason –to generate, transform and manipulate information– actually increases. Their ability to accumulate knowledge also increases as they have more experiences and more formal education on which to build.⁸⁷ Thus, while new learning becomes somewhat less efficient, their knowledge base increases well into late life.

That's because it's easier to learn new information when you already know something about the topic. Expertise has been underestimated. For example, older adults are better able to learn new information about heart disease when they already have a knowledge base about general health.^{88,89} The same is true for investment products –it's easier for older adults to learn new information about financial matters because prior knowledge facilitates new learning.⁹⁰ Research shows that older adults who have been making their own financial decisions outperform younger people.⁹¹

Aging also brings cognitive benefits. For example, as people age, they hone other skills, such as solving social dilemmas.⁹² It may be that older people are better able than younger people to evaluate the negative consequences of social decision-making. Alternatively, it could be that older adults focus on the bigger picture of how social conflicts relate to the broader values and feelings of those involved—a shift that can be described as growing “wise” and that plays an important cultural role in society.

As people age, they are motivated to learn by different factors than when they were younger.⁹³ Their goals are different, and they might find that the activities that contribute to their well-being are different than they used to be.^{94,95} For example, people's motivation to achieve personally and to be recognized for that achievement, whether at work or in other environments, tends to decline with age. Meanwhile, their motivation to use their vast repertoire of skills, help others, and preserve their resources and sense of competence tends to increase with age. Either way, the New Map of Life perspective calls on us to shift from a deficit-mindset in which we lament the losses of function that are commonly associated with aging, and to instead recognize, measure and value the abilities, knowledge, and contributions of older adults.

At the post-secondary level, there is already ample evidence that huge shifts are well underway. The conventional image of a ‘standard’ college student in the U.S. pursuing a bachelor's degree during four years at a brick-and-mortar campus, and graduating around the age of 22, has been replaced with students who vary across the age spectrum, often entering college later than 18, due to household or family responsibilities. Students may leave and then return to college to finish a degree at a later age, or enroll after a military deployment, taking on average more than five years to complete a degree.

More than 60 percent of undergraduates are now classified as “post-traditional learners,” meaning they are over the age of 25, working full-time, meeting family responsibilities, or enrolled in the military.⁹⁶ To accommodate this shift, students need to access education online or in a hybrid format that gives students the ability to move at their own pace and to integrate learning into their other daily responsibilities.

Longevity requires problem-solving and innovation, both in life and in the workplace, that rote learning and standardized testing do not promote. Along with greater flexibility, we need approaches to learning that create relevance and impact. Stanford University’s Hasso Plattner Institute of Design (known as the d.school) developed four ideas to disrupt some of the key assumptions underlying college education: the “normal” time-frame to be a student, where and when learning happens, how learning is measured, and the very purpose of a college degree.

One concept proposed is Open Loop University, which would allow students to ‘loop’ in and out of the college experience at their own pace and on their own time. Under this model, students would have six years of education to spend over their lifetime, transitioning us away from the four-year college model to one of lifelong learning.

The second idea is Paced Education, which would mean that students move through schooling at their own personalized pace rather than having to work around an academic semester or year. This would mean doing away with the traditional four-year course of study, denoted by terms like freshman, sophomore, junior, and senior and replacing them with a course of study divided into three phases that each student could pursue at their own pace, and that would be named for a student’s level of readiness: Calibrate (determining learning style and interests), Elevate (developing and deepening knowledge) and Activate (applying

the knowledge through internships, service projects, high-caliber research, and entrepreneurship.)

The third d.school concept is the Axis Flip, which would mean that undergraduates would focus on developing transferable skills and competencies throughout the higher ed experience. Undergraduate education would be organized around ‘competency’ hubs rather than around disciplinary topics like Sociology or Human Biology. Part of this idea is also to create tools to capture a more comprehensive narrative about a student’s accomplishments inside and outside the classroom.

The fourth idea is Purpose Learning, which would mean that students pursue ‘missions’ rather than majors. This would entail combining academic requirements and ‘impact’ requirements for students’ learning.

Similar concepts for impact and project-based learning are being undertaken at the high school level. In 2015, social innovator and philanthropist Laurene Powell Jobs launched the XQ Super School project to drive community-generated models for reinventing the American high school experience. XQ has funded model schools in diverse communities, and also shares design principles including internships and community partnerships where students solve real-world problems. In Los Angeles, rapper Dr. Dre and music entrepreneur Jimmy Iovine have teamed up to fund the “the coolest high school in America,” offering students in one of the city’s most impoverished neighborhoods a curriculum designed around entrepreneurship and “impact labs” to take on issues or problems in collaboration with experts from industry or nonprofit organizations.

In higher education, that means creating alternatives to the traditional academic path,



Embarking on the New Map of Life means recognizing that learning is a lifelong process, that formal education delivers only a slice of life's learning, and that the benefits of education must be equally distributed to all if we are to fulfill the potential of the extra years we have been given.

rather than expecting all students to complete a college degree as a prerequisite for success. Reducing costs is but one motive. Another motive is accommodating a wider range of interests, needs, and abilities. A recent Gallup Survey found that nearly half of parents surveyed said they wished there were more non-college options such as career academies, internships, apprenticeships, and service-learning programs available to their children immediately after high school. This finding is consistent with the concept of the New Map of Life that people will need multiple on-ramps to learning and retraining as the circumstances of their lives change. We must make it easier to get over and around the barriers to higher education that too often limit a person's chances to get back on course after a job loss, health challenge, or financial setback.

Above all, it is essential to create new pathways for economic mobility for the two-thirds of working adults in the U.S. who do not have a four-year college degree. This sizable population of 70 million working adults often find few opportunities for advancement through formal educational pathways, because they are already supporting families. Yet these workers possess considerable occupational knowledge and skills, which may be equally or more valuable to the employer than formal educational credentials. A longevity economy must recognize, reward, and serve these workers who do not have four-year

The New Map of Life calls for sustained and intentional focus on the needs of working learners and rethinking how employers assess qualifications for employment. In the conventional model, employers hire workers based in part on formal education credentials that job applicants may or may not use in the workplace. While it is relatively easy to assess and reward standardized educational credentials, it is harder to assess skills or aptitude for learning as an indicator of workplace potential.

A model that distinguishes learning from education challenges the basic assumption that college educated workers are more productive, since education builds human capital, the knowledge, skills, and competencies that make a person more productive. A related belief is that a college degree has a signaling mechanism for employers, certifying an employee's intelligence, work ethic, and conformity with social norms for achievement.

Embarking on the New Map of Life means recognizing that learning is a lifelong process, that formal education delivers only a slice of life's learning, and that the benefits of education must be equally distributed to all if we are to fulfill the potential of the extra years we have been given.

CHAPTER 7 | New Pathways for Working, Saving, and Retiring

Television shows popular with older audiences abound with ads for financial planning firms, depicting retirement as a delectable adventure. These commercials inevitably feature affluent couples who've silvered just so, eyes twinkling as they ponder a menu of delights proffered by their financial advisor – splurge on the boat or the pied-à-terre near the grandkids? Open an art gallery? Take that expedition to the Amazon or Antarctica? Message: these are the choices that result from decades of hard work, achieving milestones, savvy planning, and good health.



In a society where disparities in economic opportunity at birth are pervasive and compound throughout life, we must recognize that individual behavior is only one piece of the puzzle.

At the other end of the storytelling spectrum is *Nomadland*, the award-winning movie starring Frances McDormand as a widow named Fern who takes to van life after her husband dies and the last employer in her Nevada town shuts down. Fern falls in with a loose tribe of interstate wanderers, for whom Amazon beckons not as a travel destination, but as an employer of aging gig workers during the holiday season. As Fern and her co-workers struggle to keep pace with robot pickers swiveling from bins to boxes under a fluorescent haze in one of the company's fulfillment centers in the desert, they look anything but fulfilled.

Somewhere between the aspirational commercials urging us to own our destiny and the dystopia of *Nomadland* lies reality for millions of Americans as they reach retirement age. Good decisions play a major role, but so does good fortune. It bears noting that the film is based on Jessica Bruder's nonfiction book, whose subtitle "Surviving America in the Twenty-First Century" conveys the already daunting challenges of working, saving, and retiring in a wealthy society with a flimsy safety net, without even factoring in the additional demands of financing 100-year lives.

In a society where disparities in economic opportunity at birth are pervasive and compound throughout life, we must recognize that individual behavior is only one piece of the puzzle. A single parent living paycheck to paycheck is not so much making choices not to save or plan ahead as they are struggling to survive in the moment. Creating financial security in the era of longevity requires new pathways for working, saving, and retiring. It also calls for new policies that are responsive to the realities that working lives for many are more precarious, that family structures are more diverse than in previous generations, and that significant numbers of Americans have little to no retirement savings.

Many of these changes are urgently needed, and not only because people are living longer. The COVID-19 pandemic cracked open fault lines that were already long and deep in Americans' working lives, raising hard questions about what it means to be an "essential" worker (and to whom), the

greatest risks and costs be carried by those least able to afford them, the disproportionate childcare burdens on women in the workplace, and the desperate need for greater workplace flexibility to accommodate the needs of working parents in a society with no paid parental leave and piecemeal childcare options that convey choices and benefits to the most advantaged.

The pandemic also prompted soul-searching about the centrality and meaning of work in American culture and a renewed quest to achieve the elusive work-life balance. Americans work longer hours with fewer social protections than those in any other industrialized country. These seismic shifts signal an opportune time to develop big solutions.

Instead, we quibble over whether retirement should start at the age of 65 or 67, missing the opportunities to question, rethink, and act on the massive scale that this moment of economic restructuring demands. As we go through a real-world socioeconomic experiment the world has never seen, the pandemic is yielding valuable insights about what American workers need and want from their working lives, and how employers and policymakers might effectively respond at this juncture for the benefit of employees, families, and the interests of a post-pandemic society that is also longevity-ready.

As with health, education, and the other domains covered in the New Map of Life, we begin by challenging the broad expectations and norms underlying the outdated model, so that we can design solutions to meet the needs of the future, rather than the past. The conventional model developed nearly a century ago selects a chronological age, 65, as an appropriate benchmark for retirement, regardless of a person's health or abilities. Second, it assumes workers are financially prepared for retirements that may now span decades. As Stanford economist John

Shoven notes, "few workers can fund a 30-year-retirement with a 40-year-career." Third, it assumes that working and retirement are distinct stages of life, delineated abruptly when full time workers become full time retirees as they travel along the one-way road of life.

By recognizing how misaligned these fundamental assumptions are with current realities, we can delve deeper to innovate solutions for the challenges people encounter across their working lives. Why should gap years be reserved for high school and college students when working parents or those caring for aging parents could make equally good use? Why couldn't there be internships for 50-year-olds exploring a career change? Why wouldn't midlife reskilling not become the norm for workers who might need or want to transition away from physically demanding occupations, rather than retire? If young adults can "boomerang" between partial and full financial independence as they launch from their parental home, why can't employees cycle in and out of the workplace?

Why incentivize employers to send 65-year-old managers at peak wisdom out the door, rather than first making use of their innate advantages in mentoring to bring along the next generation of leaders? Or helping to solve the knottiest problems part-time, instead of full-time? Why assume a 55, 65, or 75-year-old worker will take more sick days than one who is 35? (Hint: they don't.) Or fail to master the latest technology like a 23-year-old? The latter may be true, but older workers typically bring different productivity-enhancing abilities to their tasks, such as emotional intelligence and superior judgment.

The New Map of Life builds in flexibility to allow for the fact that workers are human, and that humans raise and care for families during the same decades they are presumed to be in the prime of their careers. It acknowledges a wide

range of functional abilities and education. Nine million American workers younger than 65 are on SSDI (disability) payments, while many more are unable to work while falling short of strict SSDI requirements. At the same time, millions of other retirees are healthy and fully able to work, though not incentivized to do so. We challenge the assumption that retirement is good for people, when, as clinicians such as Linda Fried saw, and research shows, “mental retirement” can drive cognitive decline in some retirees, and contribute to depression for others.⁹⁸

The New Map of Life makes much greater use of human capital that now goes unrealized due to outdated assumptions and policies. By design, we include opportunities for changing course when the disruptions to earning that can be brought on by illness, disability, caregiving, divorce, job loss, or career change create financial setbacks. Any of these common life events can provoke involuntary retirement, setting off a cascade of economic and health consequences, when what a worker may often need is only a temporary, even unpaid, leave that exceeds current federal standards, a part-time schedule, or the ability to work from home.

As we saw on a massive scale during the pandemic, a lack of childcare causes havoc not only for individuals and families, but has economy-wide consequences, and they fall disproportionately on women. One analysis of data collected by the Bureau of Labor Statistics found that there were nearly 2.1 million fewer women in the labor force in December 2020 than there were in February of that year, before the pandemic-related shutdowns started.⁹⁹ While the job losses can be attributed to multiple factors, including the prevalence of women workers in service and other occupations hit hardest by shutdowns, data indicate that the Covid-related child care responsibilities account for around 20 percent of the drop in labor force participation

It is long past time for an overhaul of the conventional life course for work and retirement that evolved after the Great Depression. This course assumes a period of education that ends in the early 20s, followed by about 40 years of paid labor, ending at 65, and another handful of years of comfortable retirement, made possible by an employer-funded pension plus Social Security payments. That may have worked in the 1950s and 60s, when the boss sent retirees off into the sunset with a gold watch and pension check that would continue for life for the male breadwinner and his wife, a payout that typically lasted for less than a decade.

This model does not account for a workforce in which women, whose working lives are typically interrupted by childbirth and childcare, earn less, save less, and retire on less than their male counterparts. And the model was already under strain, as private sector employers began to phase out defined benefit pension plans during the economic downturn of the 1970s, shifting the responsibility for saving for retirement onto workers through the creation of defined contribution plans such as Individual Retirement Accounts (IRA) and 401(k) plans.

Those models fail today to meet the needs of millions in a pandemic-stricken gig economy and will be even more inadequate when the drawdown phases extend as more retirees routinely reach 90, 100, and beyond. The U.S. General Accountability Office (GAO) reported in 2015 that just over half of households 55+ had no retirement savings outside of social security or a defined benefit (DB) plan, such as an employer-funded pension. Of that group, 29 percent had no retirement savings at all, and beyond Social Security, few resources such as other savings or home equity to draw on. The rest had a defined benefit plan, typically offered to government workers, teachers, first responders, and other public sector workers, as well as many in organized labor.

This ability to recover from setbacks and course correct is essential to financing longer lives. Working longer while saving more is the standard remedy offered for retirement shortfalls, but working *differently* is just as integral a part of the New Map of Life. The New Map of Life anticipates that working lives need not be extended only by a cadre of seniors gigging for tech companies, but by a transformation of American workplace culture, in which it becomes the norm for people to have earning years interspersed with non-earning years needed for regaining health, reskilling, or upskilling, so that productivity can be extended for decades, and that these breaks occur without stigma. If corporations can restructure, why can't people?



We must address the obstacles to financial security at each life stage in order to create financial security over the course of longer lives.

These good ideas demand new savings products, along with government and employer incentives. Rather than bestowing benefits and tax advantages on workers to save one large pot of money for retirement, we need new financial products to incentivize educational sabbaticals, renewal sabbaticals, and emergency funds that reduce the risk that a temporary job loss will plunge a worker and those who depend on their paycheck into a permanent tailspin.

In the conventional life course, trajectories for wealth building are set by early adulthood, with advantages accrued by education and socioeconomic status (and closely correlated with race) compounding over the course of life. These are the years when young people become yoked by excessive student debt, which can hinder reaching other financial goals such as home ownership or saving for retirement. Midlife shocks

such as divorce, health setbacks, or job loss can also bend the trajectory in unfavorable directions. If financial mistakes or misfortune in a person's teens, 20s, or 30s permanently dim their chances for financial security at the age of 90 or 100, that is too high a price to pay at the individual and the societal level.

We must address the obstacles to financial security at each life stage in order to create financial security over the course of longer lives.

Early Adulthood

For people in young adulthood, too much debt can have adverse impacts over the life course that are often hard to correct. This is especially true of student loans. Today's young workers are more highly educated than their parents, but their diplomas come with a hefty cost. Over 40 percent of college entrants in the 2000s are projected to default on their student loans within 20 years of graduation.¹⁰² Even among those not defaulting, many struggle to repay their loans while falling short on other financial milestones such as marriage, buying a house, or saving for retirement.

For the working age population, adequate wealth accumulation has proven essential for achieving financial security and maintaining one's standard of living later in life. A key component of wealth-building is homeownership, yet soaring prices and limited supply make home-buying a receding goal for too many young working adults, even before Covid. According to American Community Survey data, the proportion of people owning a home in their 30s fell from 70 percent in 1980 to 59 percent in 2019 (Vespa 2017).¹⁰³ Compared to previous generations, workers today are acquiring less wealth through home equity and saving less for retirement.

Another critical component of wealth building is retirement planning. Only half of Americans have access to employer-sponsored retirement savings plans. As noted above, close to 30 percent of

households near retirement have nothing saved besides Social Security.

Retirement Planning

As they approach retirement, people need to make a series of decisions, including when to stop working and when to claim Social Security benefits, which will have long-lasting effects on financial wellbeing for the rest of their lives. More companies are providing a glide path for people nearing retirement in place of the traditional cliff of a fixed retirement date, allowing them to reduce hours gradually and smooth the financial and emotional transition. Research indicates about 40 percent of older Americans would be willing to take a 10 percent reduction in hourly wage, and about 20 percent would be willing to take a 20 percent reduction in hourly wage, to work part-time or under a flexible schedule.¹⁰⁴

The implementation of the glide path could be coupled with corporate and public incentives to postpone retirement. Companies can walk away from concepts such as “retirement-age” or “retire on time” in favor of flexible options that meet the needs of employees and employers. Doing away with incentives in public and private pension plans which discourage work beyond some point and promoting age-neutral policies that prolong retirement age, can increase the investments in skill training, lead to higher productivity, postpone poor health outcomes, and reduce the utilization of health care services, particularly acute care.

Reversing course through “unretiring” can also become an option, allowing older workers to continue earning and contributing on their own terms. “Retirement as a mass phenomenon, where work comes to an abrupt end at the end of a specific age for everyone, is disappearing in the 21st century,” writes Andrew Scott.¹⁰⁵

Social Security Disability Insurance (SSDI) requirements also need to be revised to encourage people to work to the extent they are able, rather

than the current policy of penalizing SSDI recipients who work, by withholding benefits. Instead, we should replace the all-in/all-out models by right-sizing benefits, depending on a worker’s degree of disability. Such changes could be especially beneficial to older workers in physically demanding occupations, for whom reduced or modified work would allow them to extend their earning years.

For older workers, flexible hours should be combined with clearer career paths, which are still largely lacking. Companies would do well to allow older workers to step back from their day-to-day roles, while capitalizing on their emotional intelligence, experience, and knowledge transfer interest by offering opportunities for internal mentoring, informal learning, and team building programs. Within the work context, research suggests that intergenerational relationships are good for workplace performance. Among companies engaged in creativity-focused tasks (rather than routine tasks), age-diverse workforces are more innovative and productive than age-segregated ones.¹⁰⁶ According to Linda Friedman, “The neuroscience of wisdom shows that older people have not only unique abilities, but having made enough decisions in their lives to know what matters, they approach complex problems with a higher likelihood of success, because they have the skills to break big challenges into actionable parts, and the patience to keep at it when a person in their twenties would run screaming.”

Diversity across nearly any dimension in a workforce, including age, increases the likelihood that new ideas or skills are available to the group.^{107,108} For people early in their career, having multiple mentors predicts career success, satisfaction, commitment, and feelings of belonging.^{109,110} Even later-career workers experience benefits from being mentored by colleagues both older and younger than them.¹¹¹ Many companies are experimenting with phased retirement options that allow experienced workers

a greater focus on mentoring and transferring their knowledge to younger colleagues before leaving the workplace. Others have instituted “returnships” to bring in experienced retired workers during periods of high demand.

Policy Options to Enhance Financial Security in Different Life Stages

Financial security is measured by several key variables, including earnings, debt management, asset building, risk protection, and financial literacy. Because of the complexity of financial planning and the unique challenges faced by different population subgroups, we cannot provide a one-size-fits-all solution to all families. In the following, we adopt a life course perspective and review policy options to tackle financial challenges in different life stages.

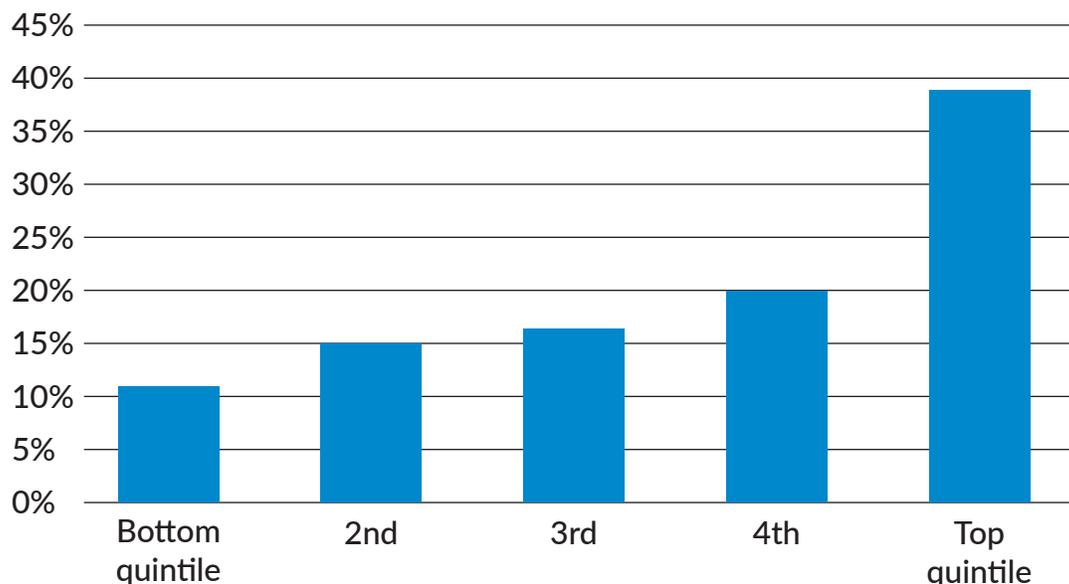
Students entering college, and their families, are not always well informed about the implications of taking out a loan of that size. While the 18-year-olds anticipate college life and a bright

future, they are less aware of the fact that a new college graduate in America earns on average about \$50,000 (in 2019). Also, college tuition has little variation across majors of studies in the same school, but future income varies substantially among graduates with different majors. The costs are not well-aligned with prospective payoffs.

Young Adulthood: Reduce Student Loan Burdens and Build Financial Literacy

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Share of Total Student Loans, 2019



Source: The Federal Reserve

One policy recommendation is to offer middle-school and high-school students financial literacy education. Basic economic concepts help teenagers understand the importance of savings, the implications of interest rates and debt, and how to balance a budget. In states where personal finance courses were mandated, credit scores for young adults increased, and long delinquency rates decreased.¹¹² For high school seniors (and their parents), financial literacy education can focus on helping them make financially sound choices over student loan debt. High schools can also connect current students with alumni who have student loan experience. Peer-to-peer interactions would paint a much more vivid picture of student loans' impact on young people's careers and life.

One of the root problems of the student loan crisis is the fast-rising college tuition. Without cost control, we are only trying to solve the question of "How to pay for it?" rather than solving "Why is it so expensive?" With the advent of Massive Open Online Courses (MOOCs), the cost of obtaining high-quality knowledge on the internet has never been lower. In contrast, the cost of attending college has risen beyond the rate of inflation.

Many young people pursue a college degree to demonstrate their credentials in the job market, even as employer expectations are shifting. Many now accept online certificates as evidence of competence when hiring. If universities and colleges don't begin cost control, young people will eventually seek alternative ways to receive education and get the credentials necessary to secure a job.

Midlife: More Opportunities to Save

Some people fail to save for the future because long-term financial planning does not come naturally to humans. Traditional economic theory assumes that people can foresee their future needs and make rational decisions. In reality, we desire immediate gratification and find it

difficult to exert the self-control required to sacrifice consumption today in exchange for consumption in the distant future. Researchers in behavioral economics and psychology have found effective ways to "nudge" people to save more. Recognizing humans' tendency towards inertia, a simple flip of the default setting in saving plans from the traditional "not enrolled until opt-in" to "automatically enrolled until opt-out," increased people's savings significantly.¹¹³ Pioneered by Nobel Prize Laureate Richard Thaler and Shlomo Benartzi, the *Save More Tomorrow* program dramatically increases savings by offering workers the option of committing themselves now to increasing their savings rate later, whenever they get a raise.

Another big problem is the lack of access to workplace retirement plans. Only about half of the workforce in America is eligible to save via employer-sponsored plans because current laws don't require all employers to offer retirement plans to their workers. Small-size firms or small businesses may find it too expensive to administer retirement plans due to IRS testing and reporting requirements for the smallest plans. Part-time employees, the self-employed, and gig workers need access to new, tax-advantaged savings plans. While new legislation brings hope to millions of part-time employees and self-employed workers to start building their retirement nest egg, the current gap in retirement preparedness between people with and without full-time employment is substantial.

Midlife: Efforts to Help Wealth-Building Through Homeownership

Research has shown that homeownership is one of the key milestones that influences long-term financial wellness. However, owning a home has proven to be increasingly difficult for young people today, especially in large metropolitan areas. By age 30, the percentage of Millennials owning homes is well below what it was for Baby Boomers at the same age. homeownership rate.^{115,116}

Second, life events such as marriage, childbearing, and homeownership often happen in clusters. The delay of marriage and family formation often seems to suppress young people's desire for home purchases (Goda and Streeter 2021; Sims and Streeter 2018).^{117,118}

Neither factor – the demographic shifts nor young people's love for cities – is likely to change dramatically in the near future. So what can we do to help people build wealth through homeownership? One key policy effort adopted by many local governments is to change the restrictive zoning laws and outdated land-use regulations that suppress housing supply. By eliminating single-family zoning and easing height and density restrictions, cities can create more housing supply and reduce housing costs.¹¹⁹ Some cities have recently approved homeowners to add secondary housing or “in-law units,” while others have adopted reforms to streamline their permitting and review process for new construction.¹²⁰

Nearing Retirement: Efforts to Promote Working Longer and Optimizing the Social Security Claiming Strategy

Many people in their 60s and 70s are physically capable of continuing working. Moreover, many have accumulated valuable work experience and are instrumental in gluing team members to achieve higher cooperation and efficiency.^{121, 122} The departure of highly experienced workers from the labor force is a waste for employers and society.

Working longer, especially when combined with postponing Social Security benefits, is associated with economic benefits. Research shows that delaying retirement by 3-6 months has the same impact on a person as would earning an additional one percent for 30 years. For some people, delaying Social Security benefits offers a significant arbitrage opportunity to have higher income in all future years.¹²⁴

First, people with less education are more likely to retire early. Older workers without a college degree reported having less flexibility than college-educated older workers in choosing their work schedule, and their jobs involve significantly more “tiring or painful positions,” “moving heavy loads or people,” “repetitive hand/arm movements,” and “standing.”¹²⁵

Limited savings can drive decisions that are not optimal. In theory, healthy people should opt to delay Social Security benefits. For people expecting to live beyond age 77, it's optimal for them to retire at the full retirement age (~66) instead of early retirement (62). If one expects to live beyond age 80, then retiring at age 70 is certainly more optimal than retiring at 62, the earliest age for Social Security eligibility. This is because the Social Security benefit structure rewards people for delaying their claims with more benefits in the long run. Despite the advantage of delaying Social Security claims, many people lack the financial resources to support themselves. Additionally, companies may be more hesitant to hire or retain older workers due to their higher wages and associated medical costs compared with those of younger workers.¹²⁶

Several policy efforts can help resolve the challenges listed above. First, a program to bridge the gap between retirement and the commencement of Social Security retirement benefits, such as the Supplemental Transition Accounts for Retirement (START) program¹²⁷ proposes additional payroll taxes would be credited to each worker's account and invested in private, professionally managed pooled accounts. Essentially, START assets would fund a Social Security bridge payment, facilitating the delay in claiming Social Security benefits by two to three years.

Second, Social Security field offices can help increase people's awareness about the financial implications claiming Social Security benefits at different ages. Third, older workers who have

already contributed to their Social Security taxes for 40 years should be considered “paid-up” and no longer be required to pay Social Security taxes if they wish to continue working.¹²⁸ This change of policy would provide an additional incentive for people to stay in the labor force. Lastly, employers are the primary payer for older workers’ (65+) medical costs. To alleviate employers’ financial burden of retaining older workers, Medicare can step in as the primary payer for older workers’ healthcare costs.

Late Life: Provide Affordable Long-Term Care

In the U.S., people rely on a few ways to pay for long-term care. If the person’s income and asset levels are below certain thresholds, Medicaid will cover their costs. The eligibility level varies by state. For the U.S., on average, a person’s income must be less than \$9,242/year to be eligible.¹²⁹ People not meeting the minimum income and asset requirements rely on private payment options such as long-term care insurance, reverse mortgages, life insurance options, and annuities. In the last couple of decades, the number of long-term care insurance providers plummeted from 125 insurers in 2000 to fewer than 15 in 2014,¹³⁰ partly due to a mispricing error by the insurance industry which had underestimated the costs for many years. As the market shrinks, it has become increasingly difficult for people to purchase a policy. People may be denied access to long-term care insurance if they have Alzheimer’s disease or any form of dementia or cognitive dysfunction, needing help with Activities of Daily Living (ADL), or had a stroke within the past two years. Together, it’s difficult and expensive to purchase long-term care insurance policies.

Given the challenges Americans have faced in paying for long-term care, it helps to consider other experiences in other aging economies. Japan, for example, launched its national long-term care insurance program in 2000. All persons aged 40 and over contribute by paying a premium, and all persons aged 65 and over can access

benefits, including institutional, home, and community-based services. The level of benefits is the same regardless of a person’s income.¹³¹

Japan’s model is worth considering in the U.S. First, Japan’s model dramatically simplifies the insurance benefit structure. Instead of a long list of confusing conditions based on income and wealth (such as when the U.S. Medicaid pays for long-term care), the Japanese model is age-based with one single age threshold of 65. Second, the Japanese model has a “flat-benefit” structure. The fact that every beneficiary receives the same level of benefits provides a high degree of certainty, which helps individuals align their expectations and make plans accordingly.¹³² Third, Japan’s long-term care insurance is a mandatory program that avoids free-riders and reduces volatility in insurance premiums.

Funding a 100-year life span must begin early in life, with intentional and careful planning. Unfortunately, today many Americans, especially the younger generations, increasingly believe it is harder to achieve financial security than did their parents’ generation. The percentage of people believing there is “plenty of opportunity” to get ahead fell from 87 percent in 1952 to just 52 percent in 2012.¹³³ It has become challenging for many working Americans to afford a home, start a family, pay off student loans, launch a satisfying career, and start saving early for retirement.

The thirty years added to life expectancy in the 20th century is a gift that allows us more time to live higher-quality lives. However, the three added decades also require careful planning to ensure that we reach the full potential of longer lives. The planning – or mapping – of each stage of our lives calls for individual effort, institutional and policy support, and continued technological innovation. New social norms, policies, and national conversations will emerge in the New Map of Life and guide us toward a financially secure 100-year life.

Part III: Investing for Longevity

CHAPTER 8 | The Road Ahead

“What if you had only one month left to live?” is a question often asked to elicit from people what matters most in life, and to prioritize time and effort accordingly. What if we applied the same thought exercise to our 100-year-lives? Would we choose to surround ourselves at every stage with those we cherish and those who might have something to teach us, or whom we might mentor in turn? Would we feel less torn taking time from the job to be present for bedtime stories and field trips, for holding the hand of a sick or dying parent or listening to a friend in need? Would we be willing, or even relish, extending challenging and meaningful work over more decades, with intervals for caregiving, learning, refreshing, and for rewards that go beyond a paycheck?

Imagining a longer timeline, we might be more willing to try the things we are not so good at and not be paralyzed by fear of failing; and if we fail, to understand that failures need not define the rest of our lives; to protect our health and maintain our fitness in ways that are fun, rather than dutiful and less likely to be sustained; to invest in ourselves through learning and saving for a future that is rich in more ways than an account balance can measure; to build our lives in places where we feel safe and healthy, where we feel we belong and have worth. As we take stock near the end of our lives, the true measure will not be in the length of our years, but in how we spent them and who was there to share the journey.

We set out to design the New Map of Life without rigid constraints, believing that one of the

most profound transformations of the human experience calls for equally momentous and creative changes in the ways we lead those longer lives. Our goal is to offer new, more flexible options for the programs, practices, and social norms that evolved when life was half as long, that more fully reflect the opportunities longevity offers, along with meaningful solutions to meet the challenges. At every step, we questioned conventions and assumptions that are so baked into our age-defined culture we may not even recognize them – or the ways in which they have limited our imaginations.



We are not dreamers, but pragmatic optimists. And we come from our work convinced that the epic demographic transformation of our time can bring greater opportunities and growth than we thought possible at the outset, and that the very real and substantial challenges to our economic and social order can be met – but only if we have the foresight to start planning now.

Like preschoolers for whom creativity and exploration are second nature, we asked “Why?”, “Why not?” and “What if?” in probing the implications of longevity on all dimensions of life. Throughout this report we have sought to make a clear distinction between aging, the *process*, and and longevity, the *measure* of long life. It is clear

from the findings of our inaugural cohort of New Map of Life Fellows that the aim of longevity is to enhance the *quality* of long life rather than its length.

That measure starts before birth and extends until life's end. How can we make the years along the way as healthy, happy, engaged, and filled with purpose as possible? What support can we count on from our families, communities, and institutions, not only when we are very young and when we are very old, but through all the twists, turns, bumps, and of course, the high points, along the way? What changes will allow all people to have the same opportunities to experience longer, better lives along all dimensions? What would the proverbial village look like, if its supportive structure nurtured not only the children?

We are not dreamers, but pragmatic optimists. And we come from our work convinced that the epic demographic transformation of our time can bring greater opportunities and growth than we thought possible at the outset, and that the very real and substantial challenges to our economic and social order can be met – but only if we have the foresight to start planning now. Rather than bracing for the “grey tsunami,” we have the chance to lay the groundwork for a society that is healthier, more equitable, and longevity-ready.

Our research gained new urgency and an unlikely tailwind during the pandemic, which demonstrated on a global scale how norms are norms, until suddenly they are no longer. The pandemic forced improvisation in daily family life, in the way students learn, employees work, managers manage, and the economy functions. It compelled us to reassess our communal obligations, the responsibilities of the private sector in sharing the costs of collective goods, and the role of government in the free market.

It accelerated the integration of technology into

our daily lives and brought us closer to a digitized future with all its potential and pitfalls. We also came to see the ways in which technology does not compensate: for the needs of very young learners and those who learn differently, for the needs of those who lack or cannot afford internet access or digital devices, for the needs of many older adults, as well as for the basic human need to connect in shared physical spaces.

The pandemic magnified the painful costs of tolerating huge disparities based on race and wealth that determine who gets access to health and healthcare, safe workplaces and housing, and educational opportunities. It raised vital and uncomfortable questions about the sacrifices asked of workers on the frontlines of the care economy, without whose unmeasured or undervalued labor millions more cannot perform their higher-paying jobs. And it made us realize that typically invisible workers are essential.

Some felt the benefits of slowing down, taking in the restorative power of nature, and a renewed appreciation for grandparents and other older people from whom avoiding the virus meant being isolated from the people they love. Our interdependence has never been more palpable. Families doubled and tripled up at rates not seen since the Great Depression, whether driven by financial necessity, the practicalities of caregiving, or emotional longing. Others created families of choice and have no intention of going their own way again.

We are emerging from a large-scale social experiment that stress-tested and accelerated many of these changes, and while we can debate questions of efficacy and fairness, given the burdens on children, teachers, essential workers, and those on the wrong side of the digital divide, the proof of concept is there. We also saw how existing social programs can be adapted with minimal costs to provide essential benefits. The

nearly 30 million American children who depend on free or reduced-cost school meals were able to avoid hunger because school districts found a way to package their meals for home delivery. The USDA even created an app “Find Meals for Kids” to help families in the program.¹³⁴ The innovation may have been forced, but is to be applauded all the same. If nutritious free meals can be sent home during a pandemic, they can also get to children during summers, when the program has traditionally paused.

We are in a unique and challenging moment that demands systemic change on several fronts at once. First is the social and economic restructuring driven by the pandemic that places greater emphasis on equity, flexibility for workers, and accurately measuring the foundational value of the care economy that underlies all other economic activity and rewarding those providers appropriately. Second are the investments and policies needed to protect communities against the increasing dangers of climate change and to transition our economy from fossil fuels to renewable sources of energy. This requires innovation in housing, transportation, and how we design our built environment to make better use of the buffering and health-promoting benefits of nature. Intersecting with both of these deep shifts are the investments, institutions, and policies that can at the same time transform our society to make the most of longevity’s promise.

As we have seen, becoming longevity-ready means changing how we define and organize all ages and stages of life to set the course for healthy and productive aging; how we learn, earn, and achieve financial security; how we value, give, and receive care; how we design the places and spaces that shape our longer lives and how we survive a rapidly changing climate. None of this can happen without dismantling barriers that have constrained life choices and chances for people based on race, gender, income, or location.

With all that in mind, here are our recommendations for change in each of the domains we have identified as essential to setting the U.S. on course for longevity.

Intergenerational Partnerships

Diversity is a hallmark of American culture. Yet at a time of unprecedented age diversity, the dominant narrative is of an “aging society” that feeds not only ageist clichés like “the gray tsunami,” but also drives misguided policies and employment practices (consider the “old age dependency ratio” and compulsory retirement ages) and lumps adults 65 or older –all 52 million– into a demographic monolith assumed to represent a drain on society rather than a largely untapped human resource.

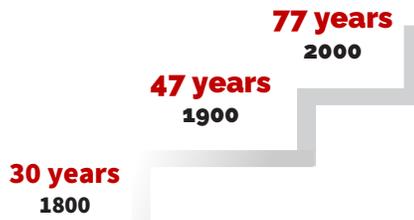
Changing the narrative to value age diversity along with all other forms of diversity is about more than semantics; it is essential to tapping the immense reserves of knowledge, experience, and skills of older adults who want to give back, and to deploying them across the country at a time of tremendous need. We can do this by scaling up volunteer programs such as Experience Corps, developed by Linda Fried and Marc Freedman to mobilize the time, talent, and experience of older adults to revitalize their communities. We can change federal tax code to allow organizations to offer tax-free stipends to volunteers to cover their costs. A bus pass, meal, or wardrobe allowance can make the difference for a low-income older adult who is able and willing to volunteer in their community but cannot afford to do so at a loss. Promoting volunteerism at the community, state, or national level brings neighbors and citizens of all ages and backgrounds together, a civic balm for our polarized culture.

There are other tools to raise awareness and reward age diversity. We can replace chronological essentialism, the notion that age is the most salient marker of health or status, with

Nearly **30 years** were added to lifespans in the U.S. and other wealthy nations in the 20th century

Children can receive more attention from grandparents and other caring adults in their lives

Life Expectancy



One in four Americans living in a household with three or more generations



Cited benefits

Multigenerational families can share financial and social resources...



Greater ease of meeting the care needs of family members



Improved mental and/or physical health



Improved finances

Enhanced family bonds

More time to continue school or job training

Workers over the age of 55 are the fastest-growing cohort, now comprising **25 percent** of the U.S. workforce.

Age Diversity Brings Profound Implications For The Workforce

Older Worker Redundant Stereotypes

Myth

Less productive



Less healthy



Less tech savvy



Reality

Older workers in knowledge jobs are superior in judgment, reliability, and mentoring skills

Older people today are in better functional health than past generations

Older workers are capable of mastering the technology requirements of their jobs.

Older workers apply their vast repertoire of skills to help co-workers improving workplace climate, thus lowering costs for employers

more meaningful measurements such as physiological or functional age, that speak to a person's abilities and vitality, contributions, or needs. Publicly-traded companies can be required to report the age diversity of their workforces along with other metrics for diversity and inclusion. We have an unprecedented opportunity to combine the unique strengths of people at every age to form high-performing intergenerational groups, whether in workplaces or through community organizations.

Housing is another critical area that feeds into the storyline of a resource war among the generations, with "greedy Boomers" blocking younger generations from their piece of the American dream, through the increasing popularity of aging in place rather than downsizing and selling as previous generations have, and through persistent opposition to building affordable housing options in their communities. We can chip away at the age and racial segregation in neighborhoods through changes in zoning policies and tax incentives to build more affordable multi-family and multigenerational housing. Each of these recommendations will help knit together multiple generations who will need and sustain each other over the course of longer lives.

Built Environment & Climate

As Americans debate whether to invest trillions of dollars in an expansive view of infrastructure that includes physical construction, and social investments to advance economic participation, let's assess their potential value through the lens of longevity: which investments will produce the highest returns for the greatest number of people a century from now?

By this standard, closing the Digital Divide will deliver returns for lifelong learners of all ages, increased labor productivity, access to healthcare, and greater equity for low-income

and rural communities. More broadly, we see the opportunity for an "Infrastructure Triple Play" to simultaneously meet three overlapping sets of needs:

1. Making investments to advance human potential, especially for Americans who have been held back by racism or poverty, thus creating conditions for a healthier, more productive and economically competitive population.
2. Re-engineering U.S. infrastructure in preparation for longer human lives, with built environments that are more walkable and that provide access to mass transit, healthcare, and opportunities for lifelong learning, and that foster intergenerational connections. We can project and measure the costs against the benefits of built environments that enhance health and productivity over the course of longer lives.
3. With some of those same dollars, investing to help communities adapt and to protect residents from the increasingly severe effects of climate change.

Governments at all levels can score proposals and award infrastructure contracts based on a bidding company's ability to deliver simultaneously on the needs for a longevity-ready society, greater resistance to climate change, and economic equity. For example, an urban design with greater access to public green space through the construction of parks, walkways, and the removal of urban freeways delivers health, longevity, climate, and equity dividends.

To promote energy efficiency without compromising quality of life, local, state, and federal governments can offer new incentives through loans, rebates, and tax policies for reducing consumption and using renewables.

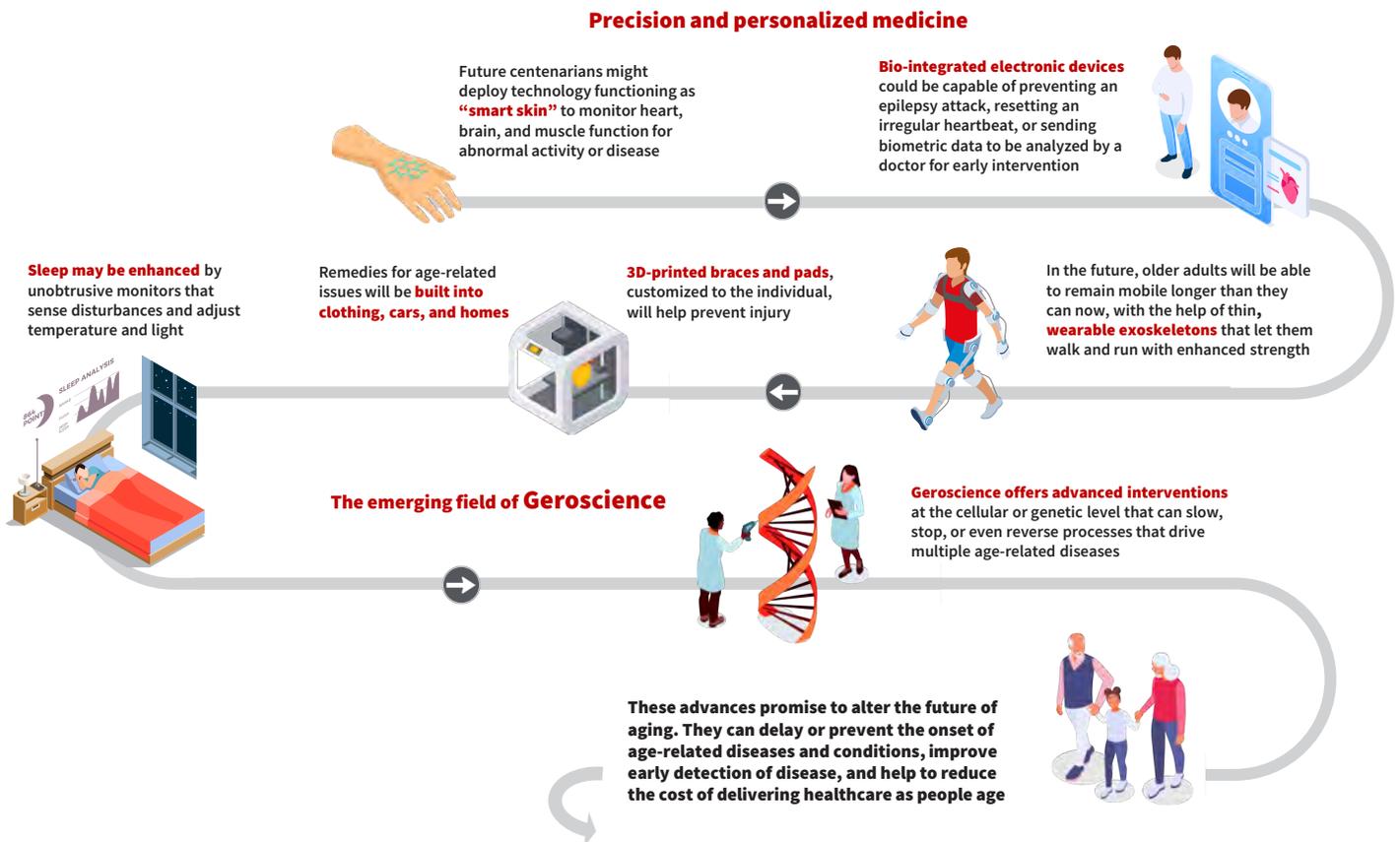
Let's make doing more with less more profitable. Similar incentives can be applied to encourage construction with new technologies such as cool pavement, cool roofs, and cool walls that help counter urban heat island effects, and employing design principles such as green/blue infrastructure that leverage the natural protective and cooling qualities of vegetation and water features in urban environments.

Health & Technology

Longevity-enhancing developments in medicine and technology promise to become even more breathtaking through advances in geroscience and precision personalized medicine, enabled through artificial intelligence. Wearable technologies such as fitness devices, smart watches, and even smart rings will allow for active, continuous monitoring by individuals and their healthcare providers, as well as public health reporting in the event of an

infectious condition. Already, home genetic testing allows individuals to map their own genomic sequence and learn which conditions or diseases they are most at risk of developing, so that they can monitor, and in many cases reduce the risk of onset. Therapeutics enabled by geroscience hold the promise of decoupling aging from the onset of age-related diseases at the cellular level, and reducing or eliminating the onset of cancers, heart disease, and cognitive impairments associated with age.

The potential for healthy aging is within reach yet making the benefits from these advances available to marginalized populations remains a major challenge. Expanding and modernizing public health into a true national system is a proven, cost-effective method of increasing access to health for all. We can employ health span as a public health tool that gives healthcare providers as well as



policymakers a more detailed and relevant picture of the conditions, needs, and disparities that contribute directly to longevity differences among different communities. “Added health span” should become a new metric for deciding how, when, and where public health funding should be most effectively directed. And expanding access to healthcare through telemedicine is vital for older adults and for people in low-income and rural communities, yet another reason to invest in closing the Digital Divide.

Lifestyle & Fitness

Becoming and staying healthy over the course of longer lives means taking on the crisis created by sedentary behavior at every age. For the youngest children, this means more play time and outdoor time instead of screen time. The same holds true for school age children, who teachers can encourage to get active with short dance sessions or exercise routines as part of planned classroom activities, or using time standing in line for jumping jacks, and through the use of kid-friendly wearable devices. Teachers can also incorporate nature into lessons through nature art projects, schoolyard habitats and gardens, as well as indoor seed growing. Infrastructure considerations also play a role in creating safe routes to schools for walking and biking.

Within families and community partnership programs such as foster grandparents, young children can be connected with older family or community members for cross-generational play, benefiting children and adults alike. Community programs have the added benefit of providing education, and mental and physical health support for older adults who participate in play.

While outdoor exercise is optimal, when it is not possible or safe, technology-enhanced exergames offer an alternative. Using immersive technologies, these games simultaneously stimulate cognitive development and healthy physical activity. Using

AI, exergames continuously modify game demands based on performance and can improve young children’s brain functioning and ability to deploy self-control skills critical for success and well-being across the lifespan. Exergames may be particularly useful for children from low-income backgrounds who often lack access to exercise equipment and safe outdoor space. They represent a promising technology-enhanced learning tool that could help narrow disparities in health and education that emerge in early childhood and widen over the life span.

As an element of the Infrastructure Triple Play, public investments can favor built environments that are more conducive to physical activity, such as creating parks and play areas that are accessible, safe, and welcoming for children, youth, families, and older adults. It is critical to avoid “green gentrification”, where new nature and recreation amenities spur cultural alienation without considering the needs and preferences of local residents, impacts on housing prices, and the costs of maintenance. Surveying local populations, and including people of different ages and races to understand how they are using the built environment, is a critical first step in any planning process.

Equity considerations are also key to improving access to affordable, fresh, and nutritious food in many low-income communities that are food deserts, neighborhoods without supermarkets or other sources of fresh food. Transportation technologies such as online grocery delivery and autonomous delivery vehicles offer some respite, as do community gardens, produce vans, and increasing incentives for farmers’ markets to accept supplemental food assistance vouchers.

Making more active and healthy lifestyles possible calls for behavior and culture changes at the individual and population level. We can address barriers to lifestyle counseling by

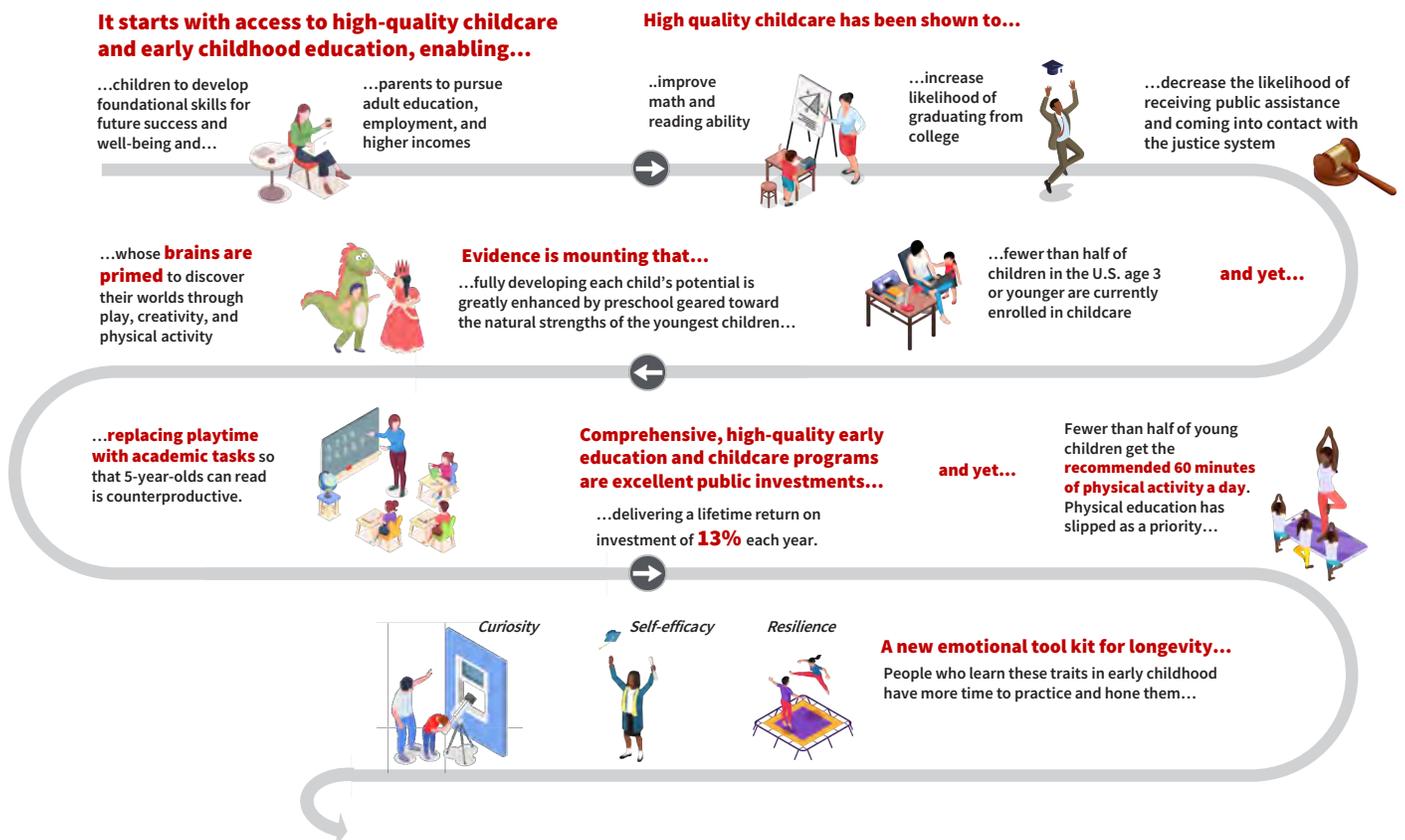
healthcare professionals who often lack time or resources for follow-up through increased funding for clinics focused on lifestyle medicine, and connecting patients with community resources to promote healthy behaviors. Training for healthcare practitioners can also include motivational interviewing techniques, which are proven to create strong, individual behavior change by supporting self-efficacy and optimism.

Early Childhood

The first five years of life set the trajectory for a child’s physical, emotional, and mental health and for learning skills, key pillars of longevity. Supporting young children means supporting their caregivers through investing in high quality, comprehensive early childcare and early childhood education. Two-generation programs that provide education and workforce training for parents deliver additional benefits.

To reduce the impacts of early childhood adversity, healthcare, childcare, and schools can benefit from incorporating principles of trauma-informed care, which takes into account how trauma can contribute to health, behavioral, and learning issues, and provides professionals who work with children tools and approaches to recognize underlying trauma and address its impacts.

Integrating social-emotional learning (SEL) programs into early childcare and education is another approach that fosters the development of skills that help individuals overcome the challenges they will face over a long life. In particular, eliminating child poverty and the lifelong traumatic impacts it can impose is essential. There is an inextricable link between poverty and learning - those children and families living day to day in poverty are much less likely to learn effectively and plan for the future.



Increasing the amount of time that is dedicated to physical activity and play in early childhood and integrating movement into early academic activities will help set active and healthy habits for life. There is no more effective time to make these benefits available to all children and families than in the earliest years.

Lifelong Learning

Four years of college cannot be expected to prepare a person to remain productive over a 100-year life, any more than a snack at the starting line could fuel a runner for an entire marathon. Rather than front-loading education into the first 20 or so years of life, we must move to a model of lifelong learning, and that means new ways of measuring knowledge and defining success at every stage. Starting in elementary school, this might mean a nationwide “Literacy Corps” to send volunteer tutors to work with low-income communities and at-risk students. These volunteers can go into families’ homes or meet them at public libraries or community centers and work with children on literacy (verbal and numeric) so they can pass the 3rd grade reading assessments.

Institutions of higher education must make even more profound changes. With costs spiraling and social resistance to student debt growing, colleges and universities can no longer defend their hold on a bachelor’s degree, earned during four years in residence, as the exclusive gateway credential for a well-paying and satisfying career. As it is, only one-third of Americans have a bachelor’s degree and about half of Americans who start a four-year college drop out, with little to show for their efforts other than debt, and possibly a bruised ego. We can replace the “college for all” message to promote other pathways into the labor market including community colleges, apprenticeships, and vocational training programs for students as early as middle school, to keep them engaged in learning. We need to make it socially acceptable and economically viable for people to have a

ladder to the middle class that does not require a traditional four-year residential college. The needs of working learners must be factored into the New Map of Life.

Community colleges are increasingly a solution for many students. With a cost roughly one-tenth of that of a private university, 41 percent of all undergraduates in the U.S. are enrolled in community college, including 39 percent of incoming freshmen. Given the lower cost of failure, students can explore possible directions for their education and careers without fear of burdening their financial future for decades to come. Community colleges can also serve as anchors of lifelong learning for students of all ages, whether they seek to reskill or learn a foreign language in retirement. They are ideal incubators not only for upward mobility, but also for intergenerational connection.

We need to revamp higher education so that there are multiple points of entry at different stages in the life course. This will open up higher education to working learners – adults who already have jobs and are pursuing a degree or credential at the same time. Working learners may be people getting a credential for the first time or later in the life course to reskill. For these students, hybrid and student-paced learning models will become the norm, and the monotony of Covid-era Zoom classes will thankfully be replaced by rich, immersive multimedia content for distance learners of all ages.

Other innovations can take us even further. Students at Stanford’s d.school proposed an experiment called “Open Loop University” that extends enrollment over six years – four years for a bachelor’s degree, plus two years to re-enroll and pursue new interests and skills over the course of their working lives. Helping to underwrite the cost could become an employer incentive. And for the two-thirds of Americans

who don't have a college degree, there must be other pathways to the middle-class. Especially in rapidly developing fields like artificial intelligence, employers are showing increased willingness to consider credentials such as professional certifications, or to administer their own

competency tests to evaluate a job applicant's real-world skills. This approach can remove college as a credentialing filter to determine who is deemed worthy of applying for a skilled position.



Work

Over the course of 100-year lives, we can expect to extend our working lives to 60 years or more. To be sustainable, even enjoyable, these extra decades in the workplace must offer greater flexibility through midlife internships and gap years, and other intervals that will space out earning and non-earning years to accommodate child-rearing, eldercare, health needs, upskilling, reskilling, and leisure.

This “Open Loop” for workers can relieve the pressure younger workers face when the demands of peak career-building years collide with the time demands of starting families, especially for women. For older workers, the Open Loop can be optimized to benefit individuals, the employers’ bottom line – and GDP. It will require changes to individual behavior, and current employer and tax policies that now drive older adults seeking a temporary respite from paid work into early or forced retirement, depriving individuals of income, employers of productivity, and governments of income and payroll taxes. Changes to Social Security policy would allow retirees who want to resume paid work to do so, without being penalized by reductions in benefits. Allowing Medicare to cover the full employee health costs of workers over the age of 65 would remove a key barrier for employers concerned that retaining or hiring an older worker would increase their healthcare costs.

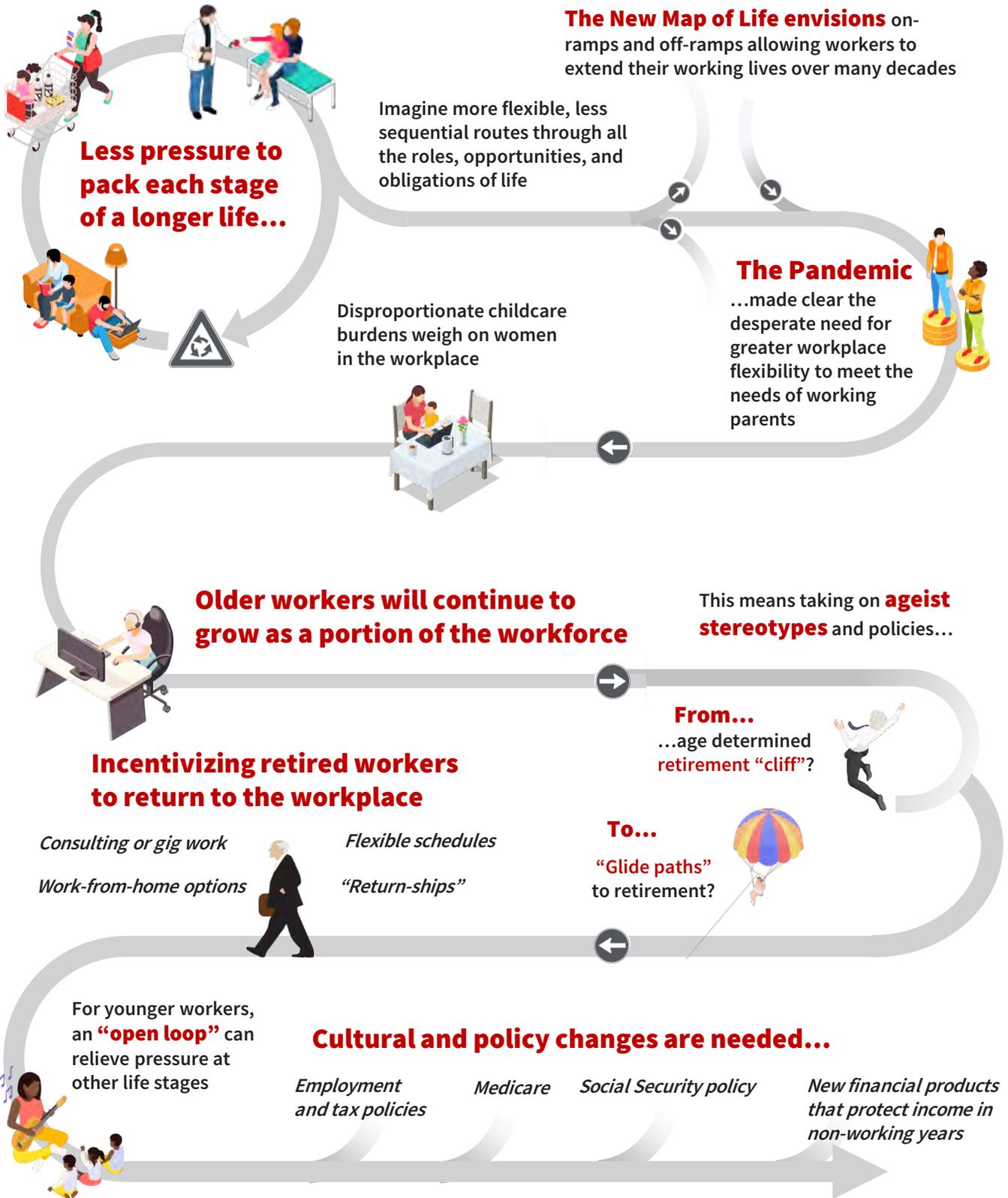
The conventional wisdom that older adults represent a net drain on resources is based on an inaccurate view that equates aging with a loss of productivity. Professor Andrew Scott has proposed a 3-Dimensional Longevity Dividend to achieve healthy and productive aging, which takes an expansive view of productivity that includes the paid labor, volunteer time, and caregiving hours of workers over the age of 65. Measuring and assigning value to the contributions of

older adults is one way to counter ageism in the workplace. Mixed-age workforces offer unprecedented opportunities to make use of complementary skills of younger and older workers. Younger workers bring speed, personal ambition, and an eagerness to learn. Older workers bring emotional intelligence, judgment, and experience they can transfer through mentoring and team-building.

In practice, this could translate into older workers contributing to retention, or coordinating apprenticeships and training programs in collaboration with public or private external partners, or supervising and mentoring younger colleagues.

Studies show that older workers are more likely to value flexibility over promotions or pay increase, drawing many to consulting or gig work, and creating incentives for employers to offer part-time jobs and work from home options.

For new parents, who show the lowest levels of job satisfaction, the key to retention and higher future productivity is childcare.



Financial Security

Financing longer lives requires changes in both individual behavior and institutional and government policies. We also need new financial products that incentivize workers and their employers to make choices that enhance financial security over the course of longer lives, starting well before retirement. In high school, financial literacy education can prepare teenagers to make informed choices about student loans for college and to become smart consumers of higher education. At a time when the costs of obtaining knowledge are declining and becoming democratized through online learning, informed student-consumers will bring added pressure to universities and colleges to control costs and stay competitive.

Workers of all ages need new savings options. Rather than one large pot of money saved for retirement or a child's college education, we need new financial products targeting educational sabbaticals and renewal sabbaticals, as well as emergency funds that reduce the risk of chronic stress from worrying about job loss. Tax policies that support the development and consumer acceptance of these products will also be necessary.

Financial education for midlife and older workers is just as important as it is for students. In planning and approaching retirement, workers need greater awareness about the benefits of working longer, and information about how to optimize Social Security claiming strategies. With appropriate employer and tax incentives, more workers can take a glide path rather than going over the retirement "cliff," often with negative financial and health consequences.

Innovations in long-term care are needed at a time when costs are soaring and long-term care insurance providers are disappearing from a marketplace designed for shorter lives. We must

combine technology innovations that enable independent living with policy reforms to make long-term care more affordable. One model to consider is Japan's Long Term Care program, into which all workers pay during their working years, and which all citizens 65 and older can draw on to receive the services they need.

We need bold and rapid innovation at scale to maintain health, productivity, and social engagement over the course of 100-year lives. If we are wise, we will invest in ways that maximize human potential from childhood through old age. If we are smart, we will be guided by science. If we are to be effective, we will rely on sophisticated economic models and be prepared to pivot when expected outcomes fail to broadly benefit enough people. The only thing we cannot afford is inaction.

We feel confident that a nation which prides itself on problem solving, ingenuity, fairness, hard work, and faith in the transformative powers of science and technology is up to the challenge. Let's get to it.

Acknowledgements

The New Map of Life reflects the input of world class scientists, dedicated philanthropists, business leaders, and community organizers. It reflects the guidance of a remarkable Advisory Council that kept the initiative focused on societal impacts every step along the way.

We owe special thanks to the present and past leadership of the Advisory Council. Russ Hill, Chairman of the Stanford Center on Longevity Advisory Council sparked ideas, provided foundational support, and offered critical guidance at every stage of the project. Advisory Council Vice-Chair, Linda Tarplin, contributed policy expertise and a critical eye that informed and balanced the effort. John (Jack) Rowe, inaugural chairman of the Council and luminary in the field of aging advised the project from its inception. Of course, we will never forget the support, inspiration, and good sense that former Advisory Council Chair, James Johnson, contributed to this work. We hope that this report would have pleased him.

The New Map of Life got its start in 2018 with a workshop co-led by Mark Cullen, then Director of the Stanford Center of Population Health Sciences, and Mark Duggan, Director, of the Stanford Institute for Economic Policy Research, in which a diverse group of experts came together to envision what high quality century-long lives could be and to identify ways to achieve them. At the 2018 meeting and throughout the effort, we benefitted from the expertise from several academic contributors outside of Stanford who became key partners in charting new maps of life.

The initiative was made possible by the generosity and vision of our sponsors, who saw the potential represented in the initiative, and contributed both financial support and a wealth of expertise and encouragement. Sponsors included Wallis Annenberg and the Annenberg Foundation, Bank of America/Merrill Lynch, Tushara Canekaratne, The Eisner Foundation, The Hewlett Foundation, Honda Motor Company, Inc., The Packard Foundation, and the Rainwater Charitable Foundation. We are especially grateful to Cenny Kennard, Surya Kolluri, Carol Larson, Jane Nakagawa, Andrew Sieg, Jeremy Smith, and Trent Stamp for their guidance throughout the effort.

At its core, the New Map of Life report reflects the work of ten Stanford fellows who worked tirelessly for two years to analyze and envision critical domains of life that must change to support century long lives. Each fellow was guided by a Stanford faculty advisor, who provided input to fellows and contributed directly to the project. Thomas Rando, Deputy Director of the Stanford Center on Longevity shared unparalleled knowledge of geroscience. A highlight of the initiative was a weekly seminar for the fellows, in which they heard from internationally acclaimed experts spanning academic disciplines, businesses, and industries and generated lively discussions and insights as they came to know each other in a richly multidisciplinary

environment. We thank all of our speakers for these invariably instructive sessions. The resulting domain reports - focused on built environments, climate, early childhood, education, financial security, healthcare, intergenerational relationships, lifestyles, and work - provided the basis for the present integrated report skillfully interwoven by Karen Breslau. During the latter phases of the project, we received strong support from our communications partners at Palisades Media and RALLY.

This report would not exist without the tireless efforts of a talented and dedicated staff at the Stanford Center on Longevity. They operate much like a family, supporting one another when needed and going above and beyond when challenges arise, even a global pandemic. It is my great privilege to work with these remarkable colleagues.



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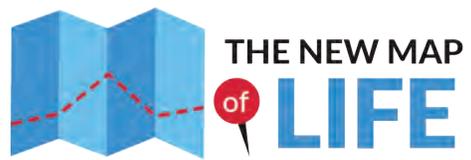
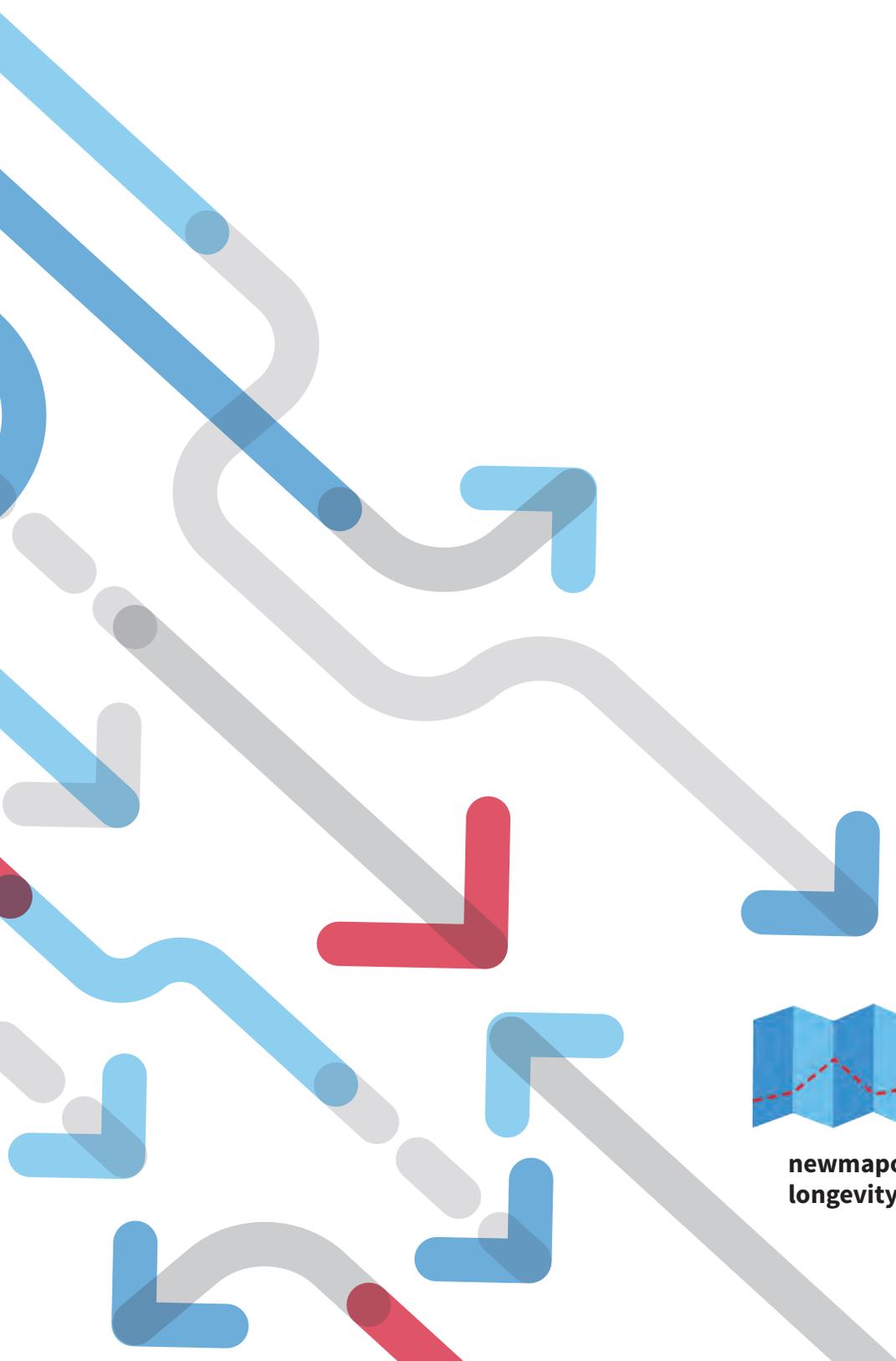
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