FUSING THE GENERATION GAP

Colorado's shifting demographics present challenge and opportunity for bioscience.

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IT'S BEEN PREDICTED, ANALYZED AND PROJECTED, its consequences debated for decades: the massive and unprecedented aging of the overall US population as the so-called Baby Boom generation reaches retirement age. But that phenomenon, which long seemed theoretical, is now in full swing. The oldest members of this demographic cohort – which includes Americans born between 1946 and 1964, and represents approximately 26 percent of the total US population – began to turn 65 in 2011. Nationwide, it's estimated that they will be reaching retirement age at a rate of 10,000 per day until the year 2030.

The aging population is especially evident in Colorado. The State Demography Office recently issued a report showing that, out of all 50 states, Colorado has one of the fastest-aging populations. It is estimated that, by 2030, the population of Coloradans older than 65 will more than double, from around 500,000 in 2010 to more than 1.2 million. This increase will be from natural aging of the current population alone.

That staggering number is only part of the story. Colorado also boasts the fastest-growing Millennial population in the US. As young adults just hitting their career stride, they are the youngest members of our state's workforce.

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These two demographic shifts prompt important questions: What will be the economic, social and health consequences of the overall aging of Colorado's population? What are the specific needs of this population, and how will those be served by current and future industries here? What bioscience research and development will address health and wellness for Americans, and what about the needs and desires of the young people who are just establishing themselves? How do those needs intersect?

One place where those questions are actively being addressed is the new Knoebel Institute for Healthy Aging at the University of Denver (DU). According to Lotta Granholm-Bentley, professor of biology and executive director of the Knoebel Institute, its genesis began six years ago with a $10 million gift from Betty Knoebel and a pilot grant program to gauge interest in an interdisciplinary program on aging.

"An important differentiation between DU and other institutions that are looking at aging is that we are not co-located with a medical school," Granholm-Bentley says. "So we have an eclectic group of disciplines, including not just biomedical science but also engineering, clinical psychology, social work – even performing arts and hospitality – involved in collaborations to approach these questions from a different angle."

The Knoebel Institute, its faculty and students are unified around a vision: Quality in life, wellness, and community. Goals include:

- promotion and expansion of research;
- the building of an interdisciplinary community;
- engagement of the university's Millennial students with the elderly community; and
- engagement with government, policymakers and nongovernmental organizations that have an interest in issues related to aging.

The broad-based exposure and training young adults will receive through the institute's initiatives will help prepare them for a creative approach to their careers as they enter the workforce and are called on to solve the country's demographic challenges.

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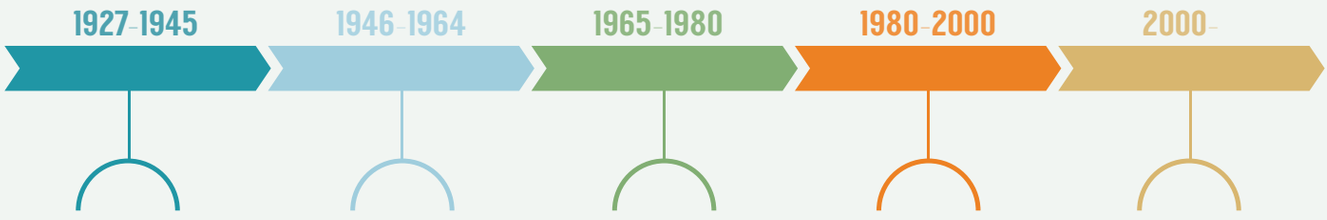
A TIMELINE OF THE AMERICAN GENERATIONS



SILENT GENERATION

They were too young to see action in World War II and too old to participate in the fun of the Summer of Love. This label describes their conformist tendencies and belief that following the rules was a sure ticket to success.

BABY BOOMERS

The boomers were born during an economic and baby boom following World War II. These hippie kids protested against the Vietnam War and participated in the civil rights movement, all with rock 'n' roll music blaring in the background.

GENERATION X

They were originally called the baby busters because fertility rates fell after the boomers. As teenagers, they experienced the AIDS epidemic and the fall of the Berlin Wall. Sometimes called the MTV Generation, the "X" in their name refers to this generation's desire not to be defined.

MILLENNIALS

They experienced the rise of the Internet, Sept. 11 and the wars that followed. Sometimes called Generation Y. Because of their dependence on technology, they are said to be entitled and narcissistic.

GENERATION Z

These kids were the first born with the Internet and are suspected to be the most individualistic and technology-dependent generation. Sometimes referred to as the iGeneration.

*Information from NPR.org

The Accera team at the November 2015 Alzheimer's Association Education Symposium educating Colorado seniors about their work developing a new treatment for Alzheimer's disease.

students," Granholm-Bentley says. "Thus a focus for the institute has been finding ways to immerse its students in collaborations with industry and health organizations."

Recently, DU initiated a collaboration between students and the Colorado Neurological Institute's neurologists and surgeons.

"We see this as a model for expanding relationships with other organizations," Granholm-Bentley says. "As an undergraduate school, we're excited about this successful effort to connect students to these opportunities."

The Knoebel Institute's future location – currently under construction – will also house engineering and computer science programs, placing the institute in a perfect position for collaboration between pre-med, engineering and other disciplines. Collaborative research programs already under way include studies in rehabilitation science to help injured elderly people regain strength and maximize their quality of life after injury. These programs focus on the interrelationships between positive physical training, biomarkers and memory function. They also build on basic research in mitochondrial oxidative stress in neurodegenerative disease and the effects of diet and nutrition on aging, health and dementia.

Alzheimer's disease (AD) and dementia are of specific concern because, both in Colorado and nationally, the aging of the population will coincide with a dramatic rise in the prevalence of these diseases. According to the Colorado chapter of the Alzheimer's Association, approximately 65,000 Coloradans over the age of 65 are living with Alzheimer's disease. That number is expected to grow to an estimated 92,000 by 2025.

AD already presents significant challenges to patients, caregivers, families, communities and facilities that care for older adults. This represents an area to be addressed through both social and scientific efforts.

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According to Dr. Charles Stacey, CEO of Accera Inc. in Boulder, Colo., AD represents a significant worldwide pandemic, and new AD treatments are desperately needed.

"There are nearly five million patients currently in the US alone, costing our healthcare system more than $225 billion," Stacey says. "With the aging of the general population, that figure could grow to exceed $1 trillion by 2050."

"What's been very frustrating is that there is a real dearth of medications to treat this disease," he says. "The five drugs available to manage the disease really belong to just two drug classes, and the last approval was 14 years ago, in 2002."

Indeed, a 2014 study published in the journal *Alzheimer's Research and Therapy* found that only 0.4 percent of the 413 clinical trials for Alzheimer's therapies conducted between 2002 and 2012 were successful.

The need for new treatments is urgent, in terms of both human and economic costs. According to a recent analysis by the Alzheimer's Association, a treatment capable of delaying the onset of AD, if it were introduced to market by the year 2025, could reduce the number of individuals affected by AD by 2.5 million within the first five years and reduce overall cases of AD by 42 percent by the year 2050. This could translate to savings in out-of-pocket and medical reimbursement costs in the hundreds of billions of dollars.

Founded in 2002, Accera has long been focused on treatments for Alzheimer's disease and currently has a lead product, AC-1204, moving through Phase III clinical trials. The study will investigate the drug's effects on memory and cognition, activities of daily life, resource use and quality of life.

What's been particularly interesting about Accera's clinical trial enrollment, according to Stacey, is how Colorado's changing demographics have enabled the company to open two trial sites and begin patient recruitment in the state.

"The majority of Alzheimer's cases occur in Florida and California, so that's where the majority of clinical trials for this therapeutic area have historically taken place," he says. "With the population of older adults growing in Colorado, we have opened two clinical trial sites here. This is somewhat unusual in our industry. If we succeed, it may provide leadership for other global pharmaceutical companies to offer their clinical trials to patients in the state as well."

Since AD is a progressive disease, the need for new, effective treatments goes hand in hand with the need for better mechanisms for early detection. CereScan, headquartered in Littleton, Colo., has developed novel, advanced functional and structural brain imaging and processing software to improve the accuracy of diagnosis for AD – as well as a range of other brain conditions, including Parkinson's disease, anxiety, ADD/ADHD, traumatic brain injury, PTSD and bipolar disorder. The goal is to begin treatment before extensive damage and cognitive decline have occurred.

Aside from AD and dementia, the management of health and wellness – as well as acute and chronic diseases, including diabetes, heart disease, Parkinson's disease and cancer – is becoming more important as the population grows at both ends of the age spectrum.

For young adults, including Millennials and generations entering midlife, increasing emphasis will be placed on wellness, disease prevention and "the quantified self." As so-called digital natives, young people increasingly rely on mobile and digital health apps and app-enabled devices to help them track their health habits with unprecedented granularity. At a time when Millennials are entering the workforce, paying for their own healthcare for the first time and building their knowledge on access and quality care, this higher level of engagement with digital health has the potential to provide increased attention to prevention, health and wellness, and to reduce healthcare costs.

Although the drive to track and quantify health parameters gained traction with apps to manage athletic fitness, exercise and diet, the range of health parameters people are now tracking has grown rapidly and continues to expand, reflecting the well-ness-oriented interests and active lifestyles of Millennials and Colorado residents of all generations. For example, Leo Technologies, based in Centennial, Colo., is developing LeoSense, a system of sensors and apps for managing individual hydration through au-tomatic, continuous, biometric monitoring. The company is collaborating with Samsung, using Samsung's Simband research plat-form, which incorporates a wide array of biosensors and flexible modularity, to test its technology.

"Our collaboration with Samsung is a great example of how digital health and bioscience are working together, more now than ever before, with the common goal to improve health and wellbeing," Steve Adams, CEO of Leo Technologies says.

Other mobile digital health companies located in Colorado include RXAssurance in Denver, whose companion applications for healthcare providers and patients – RxAdvisor and RxCompanion – collect and track patient data regarding adherence to prescribed drug regimens to help the provider-patient team maximize treatment outcomes. Telsano, with operations in Aurora, Colo., is developing a platform for capturing, tracking and monitoring personal biometric information,

With its wide array of biosensors and flexible modularity, Simband – a Samsung research platform – is the ideal testing platform for Leo Technologies.

and aggregating it with segmented body composition analysis. The data generated by Telsano's platform can be used by providers and corporate wellness programs to promote wellness and preventive health services to their patients and employees.

While not app-driven, extraordinarily advanced diagnostic technologies are being brought into the areas of personal wellness and disease prevention as well. SomaLogic, located in Boulder, Colo., is building on its successful history in protein biomarker detection to develop a "Wellness Chip" that will enable early detection of diseases and health conditions, monitor nutritional and fitness status and promote general wellbeing. The company envisions that, eventually, users will be able to monitor changes in the concentrations of key proteins in the body and make necessary adjustments to optimize health and wellness.

The proactive interest in aging-related issues in both academics and industry mirrors current efforts in Colorado state government and private industry to plan for the consequences of these major demographic shifts. Last year, the legislature passed HB15-1033 to establish a Strategic Action Planning Group on Aging (SAPGA). This group is developing a report and recommendations for strategies to address infrastructure, workforce, social, and health and welfare needs for older Coloradans.

Mindy Kemp is director of the Division of Aging and Adult Services at the Colorado Department of Human Services. The goal of her team is to provide services and assistance to older adults so they can live and thrive in the communities of their choice. She says that getting the state ready for the growing aging population is a bigger issue than just providing services to people as they age.

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>
> – MINDY KEMP, DIRECTOR OF THE DIVISION OF AGING AND ADULT SERVICES, CO. DEPT. OF HUMAN SERVICES

"We have to consider infrastructure, communities, transportation, healthcare, workforce issues and their impact on the economy and tax base," she says. "It's a really big issue that extends beyond just services. Industries like long-term care and healthcare will especially feel the impact of the rise in population, and our universities will need to be focused on how we can prepare the Millennial workforce to meet and address these challenges."

SomaLogic's "Wellness Chip" will enable early detection of diseases and health conditions, monitor nutritional and fitness status and promote general wellbeing.

According to Kemp, the combination of demographic realities, longer lifespans and an influx of migrants into Colorado means that the shift to an older overall population is here to stay.

"We tend to think of the growing aging demographic as a brief uptick in the population and then that will end, but it's a trend that will continue," Kemp says. "We will continue to have a growing, older demographic, and it's something we should all be preparing for indefinitely."