

A NEW AGE FOR OLD AGE

Our societal senior moment is on the horizon: By 2030, one in five Americans will be over 65. Now is the time to redefine aging and health.

**By Jim Duffy
Illustration by Ferruccio Sardella**





Every silver lining has a cloud. Or so it seems while scanning threatening newspaper stories that look to the future of our aging society. Social Security is going to go belly up! Medicare is going to bankrupt the country! Our health care system is going to implode!

The ominous headlines have a way of obscuring a rather sunny number that's driving all these crises: human life expectancy. A century ago, average U.S. life expectancy at birth was 47 years. Today, it is 78. And many Americans are staying spry well into their 80s and even 90s. This is *bad* news?

Not to Linda Fried. "We are in the midst of a profound demographic revolution," says the professor of Medicine, Epidemiology, and Health Policy and Management. "This country is going from one in which only 4 percent of the population was over 65 to one in which a fifth will be over 65 soon."

Such numbers are without precedent in human history. And it's happening in the span of a single, short century. So is it really a surprise that they add up to a need for revolutionary change in the practice of public health?

Shaping that change is what Fried's work is all about at the Center on Aging and Health, a center of excellence sponsored jointly by the Johns Hopkins schools of Public Health, Nursing and Medicine. Through their

research in aging, Fried and colleagues are grappling with issues that will have powerful implications in the years to come. Can we remake society in ways that better value and engage older adults? Reinvent the way we deliver medical care to those most in need?

"This is a field that needs transformative thinking and leadership," Fried says. "The underbelly of what's going on here is really exciting and interesting. The discussions we need to generate go to the heart of our concept about who we are as a society and who we're going to become as a society. We can't afford to have people keep looking at this in that gloom-and-doom way."

By 2030, the number of Americans over 65 will swell to 70.3 million—20 percent of the total population.

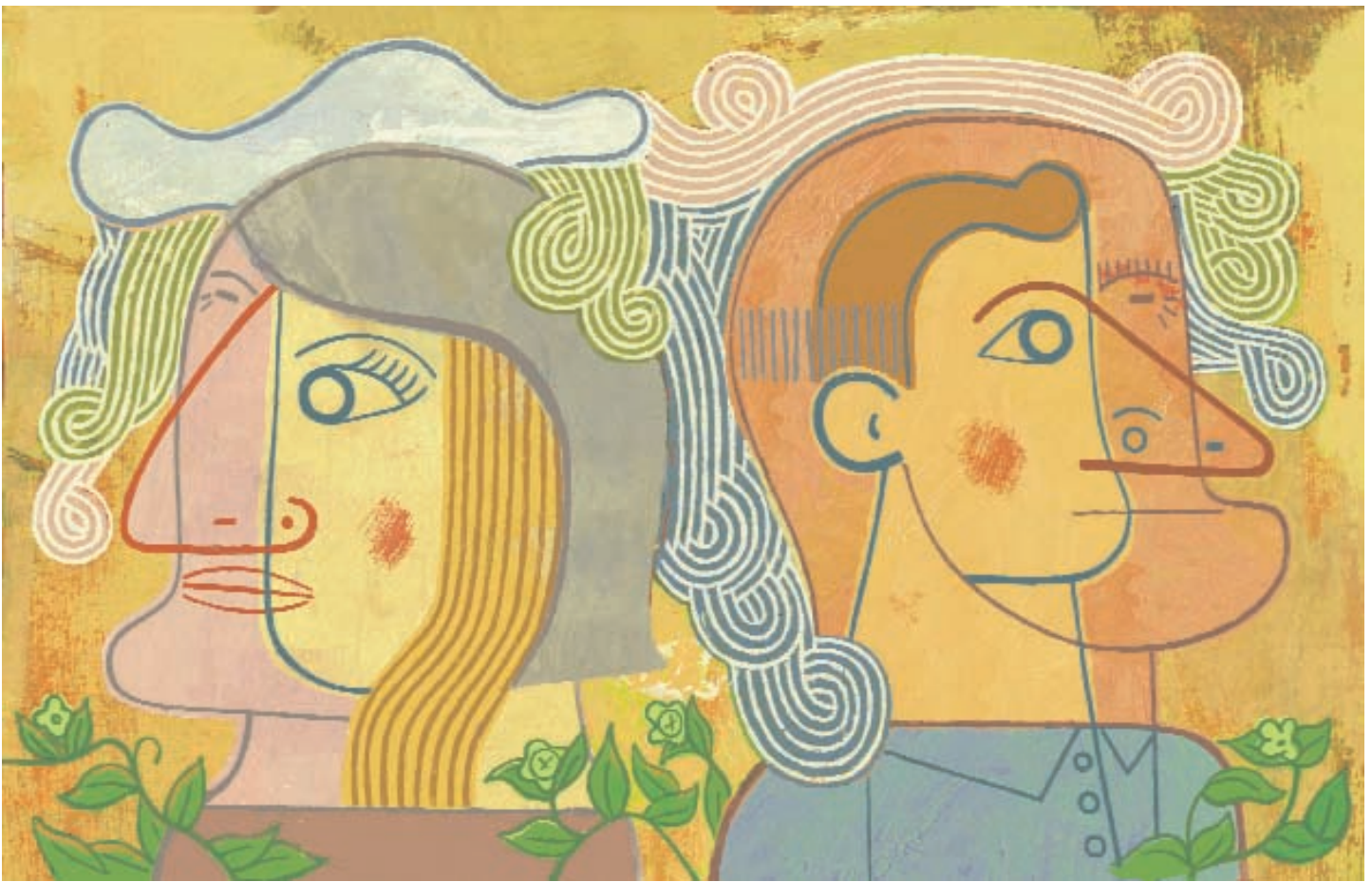
—Experience Corps

basic training

One concept at the core of these discussions is "compression of morbidity." Developed nearly three decades ago by James Fries, a Stanford professor and Hopkins Medicine alumnus, it shifts the bottom-line focus in the field away from standard mortality measures and toward the idea that success is best defined as keeping older adults healthy for as long a time as possible—and unhealthy for as short a time as possible.

Early on, the idea was controversial. Many scientists at the time regarded declining mental functioning in older adults as inevitable and irreversible. But recent studies have shown time and again that older adults can learn to think faster, remember better and reason more efficiently. Work by George Rebok, a professor of Mental Health at the Bloomberg School, has raised hopes that cognitive training interventions can promote good health outcomes and delay or prevent the onset of Alzheimer's and other dementias.

Older adults "have much more plasticity in the cognitive system than we used to think," Rebok says. "It's not just a matter of everyone is going to go downhill as they get



older and there's nothing to be done about it.”

Starting in the mid-1990s, Rebok embarked on the largest clinical investigation ever undertaken of such interventions. Dubbed ACTIVE (Advanced Cognitive Training for Independent and Vital Elderly), this study tracked the progress of nearly 3,000 participants who landed either in a control group or in one of three different training programs.

One program targeted memory skills by teaching mnemonic strategies (such as visualization and association) along with verbal techniques focused on word lists and blocks of text. A second program aimed to boost reasoning skills by working on participants' abilities to find patterns in series of letters or words. The third program focused on speed-of-processing skills and involved challenging visual searches complicated by asking participants to tackle two searches simultaneously.

Each training regimen consisted of 10 hour-long sessions. A subset of study partici-

pants also attended “booster” classes at one- and three-year intervals. Across all classes, ACTIVE was targeted to cognitive skills in a generalized sense, with no more than 10 percent of class time devoted to working on real-world problems like memorizing a grocery list or reading a bus schedule.

Initial results were published in *JAMA* in December 2006 and landed soon thereafter in dozens of newspapers around the country, as well as at the top of *JAMA's* online list of most-

requested papers. All three training programs succeeded in boosting the cognitive skill they targeted. More importantly, the study found that gains in all three training categories persisted reasonably well for at least five years when compared with the control group.

Rebok refers to ACTIVE as a “low-dose intervention.” Up until now, research efforts have focused more on pharmacological interventions or biological treatments (such as vitamin E and hormone therapy) than on approaches as straightforward as ACTIVE.

The most tantalizing of Rebok's findings came in an attempt to gauge whether the cognitive gains helped participants lead fuller, healthier and more independent lives. The study tracked evaluations by subjects of their ability to handle various “Instrumental Activities of Daily Living.” At the end of five years, all three of the intervention groups reported less difficulty with those activities than the control group, with the results for

Alzheimer's disease has surpassed diabetes and pneumonia as the fifth-leading cause of death for people over 65.

—National Institute on Aging

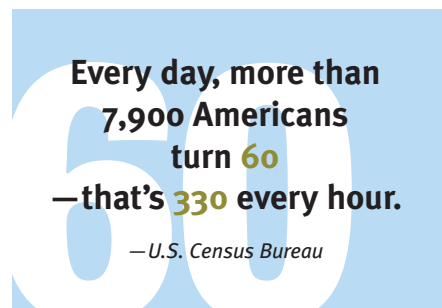


reasoning-skills training group being most impressive.

“This was the first study that has been able to show that connection,” says Rebok, PhD. “Probably more than anything else, that’s what’s got everybody really excited.”

ACTIVE is an ongoing study. Rebok plans to test participants again at 10 years after intervention. He is also working to push this cognitive-training model to another level. Would a cross-training regimen that aimed to improve all three capabilities succeed? What about a hybrid training program that mixed boosting cognitive skills with training in specific independent living skills, such as medication management or meal preparation?

“The basic theoretical model here is that these three cognitive abilities underlay most everyday activities and should generalize to those activities,” Rebok says. Study participants were tested on activities such as looking up a number in a phone book, finding and retrieving a particular item on a grocery-store shelf, and responding to signage in a simulated driving test.



“This cognitive kind of training is a lot more realistic and achievable than an intervention that tries to target a thousand different everyday activities,” Rebok says.

Another issue on the horizon is what form these interventions may take in the future. Cognitive-training websites like *Happy Neuron* and *Train My Brain* are up and running already. Rebok himself is working with a group of investigators funded by the National Institute on Aging to develop a Web-based “Memory University®” that will deliver mnemonic training classes, information about the nature of memory, and memory assess-

ments targeted toward older, independently living adults.

“The accessibility of the Internet provides an excellent means by which to provide practice opportunities and periodic booster sessions for older adults,” Rebok says. “This is going to be a real question for the future. How do you develop scientifically sound programs that are accessible and that are enjoyable and that people will stick with for a long period of time?”

guiding light

In medicine, specialization has its advantages. It offers patients easy access to physicians with expertise beyond the reach of primary-care generalists. It brings those specialists together into highly focused fields of inquiry that push medical science forward in efficient, targeted ways.

But specialization has a downside as well. In 2005, Chad Boulton, the Eugene and Mildred Lipitz Professor in Health Care Policy at the Bloomberg School, described in *JAMA* the hypothetical case of a 79-year-old woman battling five chronic conditions. She'd

DISCOVERING THE BIOLOGICAL ROOTS OF FRAILTY

Most people can recognize frailty: It's somewhere in the mix of advanced age, stooped shoulders, wobbly gait, iffy grip and shrinking body mass.

But where, exactly? Biostatistician Karen Bandeen-Roche is seeking to translate frailty into precise diagnostics by studying participants in the Women's Health and Aging Study.

Actually a progression of linked studies dating back to the early 1990s, WHAS is tracking the progress of women as they age in an effort to determine predictors of the changes in physical functioning that lead many older adults to experience difficulties completing everyday tasks. Frailty is more than just a matter of weakness and low energy levels, however; it's also strongly associated with falls, hospitalizations, disability and death.

One hypothesis Bandeen-Roche, PhD, is testing posits that frailty is a full-blown syndrome rather than a mix-and-match collection of symptoms. For a study published last year in the *Journal of Gerontology*, she tried to employ a combination of five measures to distinguish the frail from the non-frail: weakness in a hand-grip test, observed walking speed, amount of reported physical activity, level of reported exhaustion and weight loss over time.

If frailty is a syndrome, those measures should aggregate quite clearly into two main groups: the frail and the non-frail. In fact, that's just what happened with the numbers.

Now Bandeen-Roche is trying to understand the biological roots of the proposed syndrome. Working through the Johns Hopkins Older Americans Independence Center, she's looking for biomarkers that may help predict who is most at risk of becoming frail. Interventions designed to delay or even prevent the onset of frailty could then be targeted more efficiently and more effectively.

She is also part of a new working group of researchers from various disciplines who are sharing ideas about how to delve into the biological underpinnings of frailty. Bandeen-Roche was originally trained as an engineer, and she still sounds like one when describing where this work might lead.

“If you have water behind a dam, there are forces at work that may become so great that the dam breaks,” she says. “Whatever those forces are—rainfall, erosion, or what have you—we can describe them in engineering through a system of equations. We can make some predictions and prepare for things. We want to do the same thing with respect to frailty.”

—JD



likely need to juggle appointments and instructions from at least six different physicians while taking 19 doses of 12 different medications every day and managing four different sets of specialized dietary guidelines.

Who makes sure each of those doctors knows what the others are doing? Who checks to see if that woman is capable of handling the raft of paperwork and instructions coming her way—or that she has help if she needs it? The short answer, in too many cases, is no one.

“There is no organizing force for the health care of these older patients with multiple needs,” says Boulton, director of the Roger C. Lipitz Center for Integrated Health Care at the School. “And these people tend to be the oldest, the most disabled, and the most frail of our patients. They have the poorest health. They have the poorest quality of life. And they get the poorest health care.”

They also rank among the most expensive patients in the health care system, thanks to their propensity to spend an inordinate

amount of time in hospitals. In fact, care for the sickest 20 percent of older patients eats up 80 percent of the nation’s Medicare expenses, Boulton says, and that makes this population a critical one in any effort to reduce societal health care costs.

“Everyone who’s run the financial numbers on Medicare comes to the same conclusion,” Boulton says. “It’s economically unsustainable looking ahead, and something has to change soon.”

The average 75-year-old American has three chronic medical conditions and regularly uses five prescription drugs.

—Alliance for Aging Research

Boulton and a team of colleagues at the Lipitz Center are deep into testing one promising prospect: Guided Care. The initiative places specially trained nurses inside primary-care practices to work exclusively on a caseload of 50 to 60 older adults suffering from multiple chronic conditions. The training regimen these nurses go through focuses on seven different care techniques that have been proven successful in different settings, including care coordination, caregiver support, proactive coaching and evidence-based planning.

“I like to say we stole all the best ideas we could find,” Boulton says. “What’s novel about Guided Care is not any one of the strategies by itself, but the way we combine the interventions and make them all available to the patient when the patient needs it, where the patient needs it, and from a person the patient trusts.”

Already successful in a small pilot study, Guided Care is now being tested in a five-year clinical trial. There’s a strong element of patient empowerment in the program’s approach.

Nurses work with patients to develop a comprehensive health care plan that lays out in a clear, manageable format the steps patients need to take to promote good health outcomes.

“That’s such an important part of this,” says Lya Karm, MD, a primary-care physician working in a Kaiser Permanente practice in Washington, D.C., that’s part of the study. “We don’t have results yet, so I can only speak from my impressions. But I’m getting the sense that this aspect of it is really working. I hear these patients asking different questions, better questions.”

Kathleen Grieve, RN, is one of seven nurses specially trained in Guided Care techniques who are participating in the study. She works at the White Marsh, Maryland, office of Johns Hopkins Community Physicians.

“I can already say that as a nurse that I’m highly sold,” Grieve says. “I think it’s a fantastic model for primary care.”

In her experience, many older patients are reluctant or forgetful when they need to ask important questions of their physicians. Some are simply more comfortable talking with a nurse, while others enjoy the fact that the job of Guided Care nurse is structured so that they’re more readily available to patients than most physicians can afford to be. That this nurse works directly in their physician’s office rather than for an insurance company or an outside social service agency adds to that comfort level, Grieve says.

Guided Care nurses are also able to do

**Chronic health conditions
limit the activities of
34 percent of Americans
over 65.**

—CDC

things many physicians simply don’t have the time to do, such as making routine monthly checkup calls to patients and going out on frequent home visits. On one such visit, Grieve found that one of her patients was removing medications from their original bottles and repackaging them, a highly dangerous practice.

Several of her own patients, Grieve says, have described the program along the lines of “having a nurse in the family.” The Guided Care nurse serves as a friendly and knowledgeable advocate for patients—a one-stop-shop for their medical issues.

While recruiting primary-care physicians to join the study, Boulton encountered some reluctance. Physicians worried initially about the time and paperwork demands involved in dealing with an extra nurse, but he says that physicians participating in the study are finding that such demands are offset by the work these nurses take off their plates.

“This is not an effortless thing for physicians,” Karm says. “It takes some time and involves some extra meetings. But it’s one of

those things where you can pay a little bit up front or maybe you pay a lot more later when someone ends up in the hospital.”

Do these patients in fact experience better outcomes and spend less time in the hospital? That’s going to be a critical measure when it comes to the future of Guided Care. If third-party payers are going to accept the added cost of hiring a Guided Care nurse, the initiative is going to have to save them money in the long run.

By Boulton’s estimate, that means the initiative needs to reduce hospitalization at an average rate of at least one day per patient per year. Guided Care passed that cost-efficiency test in the small pilot study, and the measure will be a critical finding for the larger clinical study as well.

“If we’re going to improve health care in a cost-effective way, we’re going to have to aim at this 20 percent of the population,” says Boulton, whose Guided Care initiative was highlighted in an April 30 *New Yorker* article on aging.

When Boulton thinks now about the hypothetical case of that woman juggling six physicians, four diets, and 12 medications, he ticks off a lengthy list of the ways Guided Care could help her stay healthier and more independent. Her nurse would act as a coach to help her manage medications and diets while checking in frequently to gauge her progress and help determine whether she needs help from family members or community resources. The nurse would review her med-

A FIELD IN NEED OF NEW RECRUITS

Are students and young researchers reluctant to enter the field of aging research? As chair of the MPH program at the Bloomberg School, biostatistician Ron Brookmeyer sees evidence for this in each new crop of arriving students. They sign on in droves to study international health and AIDS, but Brookmeyer, PhD, puts average enrollment in the aging curriculum at all of “a couple of students.”

“We don’t have the workforce we need right now,” says Linda Fried, director of the Center on Aging and Health. “I think it has to do with a sense of futility that people have when they think about aging. It probably has to do a little bit with ageism,

too. That combination makes this a field that’s just not seen as sexy, if you will.”

Researchers already at work in aging insist that such reluctance is misplaced. They see it as a field full of opportunities with potential to advance the science and practice of public health in ways that will make a difference for the future not just of older adults, but of the broader population as well.

“This is an untouched frontier in many ways,” Fried says. “People who really want to make a contribution have a wide-open opportunity to do that on a whole range of different levels.”

—JD

ication lists regularly to make sure all her physicians were on the same page.

In case of problems, the patient would have access to rapid intervention by someone familiar with her conditions. Boulton recalls the real-world case of a patient in a Guided Care trial who called his nurse the Friday after Thanksgiving one year complaining of shortness of breath. In a matter of hours, his nurse had contacted several of his physicians, arranged for new medications and located a pharmacy that would make a home delivery on a holiday.

“He’d had that same sort of attack before and ended up in the hospital,” Boulton says. “This time he was able to stay home and spend Thanksgiving weekend there. This is really all about moving patients from being overwhelmed and frightened by their situation to being informed and relaxed, to being in a position to know what they need to do and to get help when they need it.”

Americans 65 and over contributed 96 hours of volunteer service per year; the U.S. median commitment is 52 volunteer hours annually.

—U.S. Department of Labor

clearing the cobwebs

Often, what scientists learn early on about a disease is simply what’s easiest to see. Consider the connection between Alzheimer’s disease and memory loss. It’s hard to hide a failing memory as frustrations pile up over lost keys, forgotten appointments and misplaced checks.

Those are the moments that early-stage

Alzheimer’s victims (and their family members) view as the first real sign of trouble—and that’s what they’ll tell their physicians. But Michelle Carlson, PhD, an assistant professor of Mental Health at the School, is looking for earlier and less obvious signs; she’s especially interested in the brain activity neuropsychologists dub “executive function.”

“It’s all up here in the front,” Carlson says, tapping the top of her forehead. “The frontal lobes, particularly the dorsolateral frontal lobes, they sort of lead you around all day. If you’re out driving in your car, you end up making thousands of decisions about everything from where to turn to when to brake and what to look at. For most people, it’s fluid. The brain functions that make it seem easy are right up here.”

Carlson’s effort to track executive function is tied in with Experience Corps Baltimore (ECB), a project of the Center on Aging and Health. It places older adult volun-

SEEKING SIGNPOSTS FOR ACTION IN ALZHEIMER’S NUMBERS

Bio-statistician Ron Brookmeyer doesn’t hesitate to use the word *epidemic* when discussing Alzheimer’s. “This disease may not be what people in public health are usually thinking of when they use the word,” he says. “It’s not infectious; it’s a chronic disease. There are demographic trends involved instead of transmission patterns. But it’s a significant change in disease patterns that’s going to present enormous challenges.”

Brookmeyer, PhD, took his first peek at the numbers of Alzheimer’s cases that might loom ahead for the United States and its health care system in 1998. That paper now ranks among the most highly cited from the *American Journal of Public Health*.

More recently, Brookmeyer worked with research associate Elizabeth Johnson to build on that model and create a worldwide forecast. There are an estimated 27 million cases of Alzheimer’s today, according to their model; it predicts that the number of cases will quadruple within 50 years to more than 100 million. At that point, one of every 85 persons in the world could have Alzheimer’s, with more than 40 percent of those cases in a late stage necessitating the highly expensive equivalent of nursing home care.

Preparing the forecast was a complex undertaking. Baseline Alzheimer’s numbers are surprisingly hard to come by, as it’s not a reportable disease. In addition, diagnostic standards vary widely depending on what country and region is being considered.

Brookmeyer and Johnson eventually developed their own

software so that they could adjust input data in ways that allowed them to ask a couple of strategic questions: What if public health and medicine succeeded in delaying the onset of the disease? What if its progression were delayed?

“As much as we want to hit a home run and come up with a cure, that might be asking too much,” Brookmeyer says. “What we wanted to know is, what if we can slow the clock a little?”

The answers were startling—and encouraging. Even a one-year delay in onset would reduce the number of Alzheimer’s cases in 2050 by 12 million. A two-year delay would reduce that burden by 23 million cases.

The picture is more complicated when it comes to delaying disease progression, but it remains positive. A two-year delay in progression could result in 5 million more cases of Alzheimer’s in 2050. However, there will be 7 million *fewer* cases in the high-cost late-stage of the disease. This may sound like a contradiction, but it’s a logical result of the competing risks experienced by older adults. Alzheimer’s is not the only health issue these patients face, after all, and more of them will succumb to heart attacks or diabetes before they ever reach the late stage of a delayed Alzheimer’s.

“That turns out to be the real take-home message here,” Brookmeyer says. “Modest improvements like these can have a tremendous public health impact.”

—JD

teers in public schools to work for a minimum of 15 hours a week with young students in kindergarten through third grade. The program's design reflects Linda Fried's view that society should view older adults more as a resource than a burden. A team of researchers is evaluating if the program improves the health of volunteers as well as whether it boosts the academic progress and behavioral record of students.

Carlson has been involved with studying ECB participants for seven years now. At first, she focused on the question of whether they get the same benefits from volunteering in schools as participants in other studies gain from cognitive-stimulating exercises like crossword puzzles and games.

"It was encouraging," she says. "There were indications in the data that we can broaden the range of activities we think of as interventions. That might be quite important: Are we unnecessarily restricting the options people have to improve their health? Some people don't like crossword puzzles. And these interventions where people are told to do exercises that are good for them tend to be a bit like New Year's resolutions—notoriously hard to stick with."

ECB, on the other hand, asks participants simply to share their wisdom to help others, playing to a common desire among older adults to give back to the community and to a younger generation. That's what attracted Judy Marshall of the Woodlawn neighborhood in Baltimore City to the program. She signed on after seeing a call for volunteers in an AARP newsletter.

After completing a training program, she got placed in a class at Cross Country Elementary School in Northwest Baltimore. There she helps a teacher with everything from teaching reading to promoting good manners to dealing with behavioral problems. "It's been three months now, and mainly I'd say it's been fun and interesting," Marshall says. "But it's been challenging, too. I haven't dealt with children in such a long time."

Carlson began thinking about looking into brain-related changes in executive functioning of ECB volunteers almost as soon as she became involved in the project. In part, this interest was sparked by the extraordinary reviews the volunteers themselves gave to the

**In the developed world,
the number of people who
are over 100 years old has
doubled every decade
since 1950.**

—NIH

ECB experience. "They would say things like, 'It's like removing the cobwebs from my brain,' or, 'I really feel sharper, like I'm using parts of my brain I haven't used in years,'" Carlson says.

She is now attempting to measure whether those anecdotal reports correspond with measurable improvements on both cognitive tests and biological measures of brain functioning, especially in the frontal lobes so important to executive function. The early data are encouraging. In a pilot neuroimaging study comparing ECB volunteers with a carefully matched control group on a series of cognitive exercises, the intervention group showed measurable benefits in cognition and related prefrontal brain regions.

That pilot had just 16 participants, however. Carlson is now embarking on a larger study of 80 new ECB volunteers. As in the pilot, she's administering a functional magnetic resonance imaging (fMRI) exam to participants before and after the intervention. This test tracks changes in patterns of blood flow and blood oxygenation through the brain while patients are engaged in cognitive tasks such as detecting patterns in a series of arrows.

"What is exciting about this pilot is that we were able to see reliable changes in brain activity using fMRI," Carlson says. "They were showing real improvements in the prefrontal cortical pathways after the intervention, and they were better at processing and

**By the middle of the next
decade, people over 65 will
outnumber children under
five for the first time in
recorded human history.**

—National Institute on Aging

filtering distraction, as well as visually focusing on a target."

Marshall has been through only the baseline test so far. She can't say for sure whether her classroom work is making a measurable difference. "All I know is that it gets me out of bed and out of the house and doing something worthwhile," she says. "That's the main thing, and I think it's an important thing, too."

The fMRI results will target Carlson's special area of interest, the potential relationship between executive function abilities and the onset of Alzheimer's disease. Testing conducted over several years by Carlson and Fried as part of the Women's Health and Aging Study II at Hopkins found that older women initially free of cognitive impairment showed declines and deficits in executive function tests over a three-year period *before* they started experiencing memory failures. Carlson's new study will also track biomarkers related to brain health, such as cholesterol and inflammation levels.

"That data could really help us understand mechanisms related to the behavioral improvements we see in this intervention," she says. Is it, in part, because participants are more physically active? If so, then the biomarkers might reveal strong cardiovascular improvements. We've yet to understand the combined effects of ECB, which increases cognitive and social, as well as physical, activity.

"Marrying these fMRI results with biomarkers is going to yield interesting insights," she says. "Integrating the pieces of this work is so much fun right now. It's like we're watching all these horses come out of the gate, and we have some hypotheses about how they're all running together to boost function. So far, our ideas about the brain's potential for plasticity in ECB seem to be bearing out."

Carlson's research marks a new chapter in the study of Experience Corps volunteers, but it's one that remains true to the vision that inspired Linda Fried to start ECB in the first place: Can we turn the older world that's up ahead into a better and healthier one?

"You know, devaluing about a quarter of our population is not a healthy thing for our civilization," Fried says. "I fear that we've lost touch with the fact that older adults bring tremendous benefits to society, and that there are real opportunities ahead in being an older society." 🍂