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# THE FUTURE OF HUMAN LONGEVITY: HOW VITAL ARE MARKETS AND INNOVATION?

## HEARING

BEFORE THE

## SPECIAL COMMITTEE ON AGING UNITED STATES SENATE

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# THE FUTURE OF HUMAN LONGEVITY: HOW VITAL ARE MARKETS AND INNOVATION?

**TUESDAY, JUNE 3, 2003**

U.S. SENATE,
SPECIAL COMMITTEE ON AGING,
*Washington, DC.*

The Committee met, pursuant to notice, at 10:09 a.m., in room SD–628, Dirksen Senate Office Building, Hon. Larry E. Craig (chairman of the committee) presiding.

Present: Senators Craig, Carper, and Stabenow.

## OPENING STATEMENT OF SENATOR LARRY CRAIG, CHAIRMAN

The CHAIRMAN. The Senate Special Committee on Aging is convened.

Good morning everyone. Let me thank you all for attending today.

What a pleasure it is to share with you a phenomenal fact current in America today. People are living longer than ever before and, in most instances, living better. Americans enjoy an average life expectancy of almost 80 years of age. If you are Bob Hope, that life expectancy is 100 years and holding. Just last week he turned 100 years old and, in typical Hope style, declared that he was so old they had canceled his blood type. We are currently investigating that type of blood.

The future of human longevity, especially for Americans, seems bright indeed. Research on extending longevity has been legitimized over the past decade by advances in biotechnology and genetics.

These advances have occurred largely in industrialized, free enterprise democracies. We hope to learn more about the powerful link among market processes, innovation, and human longevity. Longer life spans will have dramatic impacts on America.

Today's hearing will examine and educate us on the market, innovations, connections to longevity, and the impact such trends could have on our lives. Specifically, we want to learn more about the power of market forces to quietly spawn medical innovation, promoting longer lives and improving the quality of life for older Americans, and we want to better understand the long run pressures on Medicare and Social Security looking at the future of life expectancy in this country.

The topic of today's hearing is especially relevant at this time. Within the month legislation to improve and strengthen Medicare will likely be before the full Senate. Increasing choices in Medicare

as the baby boomers move into retirement over the next 5 to 20 years is critical to delivering high-quality and cost-effective care.

Similarly, our Social Security system faces the same challenge of an aging population. The future of Social Security is no less important than Medicare to America's seniors.

Our hearing today will help enlighten the Congress regarding the promises, blessings, and challenges of increased longevity.

So with that, today's first panel, we are pleased to have three witnesses. Testifying before the committee today is a longtime friend and associate, a Congressman, former Speaker of the House, Newt Gingrich; an expert in markets innovation, and in health care. Joining Speaker Gingrich on the first panel is Dr. Richard Hodes, Director of the National Institute on Aging, and Dr. Peter Boettke, Director of Global Prosperity Initiatives at George Mason University at the Mercatus Center.

Gentlemen, thank you all very much for being with us. Newt, Congressman, speaker, welcome to the committee and we will turn the time to you.

**STATEMENT OF NEWT GINGRICH, Ph.D., FORMER SPEAKER, U.S. HOUSE OF REPRESENTATIVES, ATLANTA, GA**

Hon. GINGRICH. Let me say, first of all, thank you, very much, Mr. Chairman.

I think the topic you have raised is amazingly important. Let me just give you a specific example. I talked to one of my closest advisors last night, Dr. Steve Hanser, who had just spent a month in Europe. I said what were you seeing in Europe?

Being a typical American with President Bush traveling, I thought I would get sort of a feedback about U.S.-European relations. He said, "I was in four countries and I saw four topics: pensions, pensions, pensions, pensions."

He said there is a pension system crisis in every European country he visited that he was followed by a health system crisis and followed by unemployment because the European answer has been to stagnate with a welfare state they cannot afford, which has actually caused a tremendous loss of jobs.

So you are placing on the map with this hearing the moment to decide whether successful aging in America is an opportunity or a problem. I would argue that it is an opportunity, and that only bad public policy turns it into a problem.

If you look at the total range of scientific breakthroughs that we are currently developing, we are about four times the speed we were in the 20th century. That is, literally between 2000 and 2025, We will have as many breakthroughs in new science and new technology as we had in the entire 20th century.

Information technology, biology, and nanoscale science and technology are the key areas. Dr. Sam Stupp, who is a world class specialist in nanoscale science at a firm called Nanomateria, believes that within a decade we will begin to see the ability to regenerate spinal cord injuries, to potentially regenerate retinas, and that this kind of breakthrough, this consistent evolution, is incredibly important in developing the future.

If I could draw sharply the contrast something that Bill Novelli, the head of AARP has often discussed baby boomers want a second

start. They do not want a long retirement. They do not want a period of doing nothing. They do not want to decay. They do not want to be a burden.

They want to see the years of aging as a process of healthy independent living where they are doing interesting things in a way that is significant. It is vital that we not allow bureaucracy to cut-off access to all the new developments, all the new technologies, and all the new opportunities.

I find it a great irony that in competing with the Soviet Union and in advising Third World countries, we consistently say that market systems work better than centralized bureaucracies, yet in health we stay with centralized bureaucracies.

In the book that just came out that I co-authored, Saving Lives and Saving Money, we outline how to move toward a much more market-oriented system. At the Center for Health Transformation, we are developing those ideas. I can summarize it in four driving principles and then one example.

The first principle is patient safety and patient outcome. If we simply design a system where we allow patient safety and patient outcome to be the dominant factor, we will rapidly see the kind of changes we need. For example, electronic prescribing would save dramatically in doctors' time, in money, and in patient safety. Forty percent of all prescriptions today require a callback either because the pharmacist cannot read the writing, because the medicine prescribed is inappropriate, or because there is a less expensive medication available that the doctor could use.

The result is that people die, and people get sick. Medication error is the largest single cause of senior citizen emergency room visits. Yet, we have had for years a palm pilot model of electronic prescription which would save money and save lives.

So the first thing we ought to consider are the appropriate outcomes? In Medicare, for example, you would have a comorbidity management system for everybody because 50 percent of all Medicare spending is on 5 percent of the population, and that 5 percent has five or more comorbidities. That is they have five different diseases simultaneously. If you handled them as five separate diseases in one human being, you get all sorts of secondary effects. But if you deal with the person as a single person, you have enormous improvement in their outcomes, as demonstrated with two quick examples.

There is a firm called Evercare which specializes in people in nursing homes over 80 years of age, a third of them with Alzheimer's.

They put together an electronic medical record, and the first thing they do, on average, is reduce the senior citizen from 22 medications a day to 6. Sixteen fewer drugs a day. That reduces hospitalization by 50 percent.

It is an amazing outcome story. So, the Medicare reform this year should absolutely include comorbidity management and making sure that people have all of their diseases treated in a medically correct way, something which Dr. Zerhouni out at NIH is working on and believes could save up to 40 percent of the cost of the current system.

The second principle is to take all the breakthroughs in information technology and computerization and apply them directly to the health system. It is possible today to have an electronic intensive care unit. There is a firm called Visicu that has one. Both of the examples are in Saving Lives and Saving Money.

That electronic intensive care unit, it is estimated by the Sunterra Hospital System, is saving one life per bed per year in better care. It is accelerating recovery by 20 percent, allowing them to use the same number of intensive care beds more often, and it is improving nurse retention while minimizing hospital-induced illnesses.

Now this is a fact. What I am describing is not a theory. The Senate can visit Norfolk and see a facility at work today which is changing history. If you apply information technology across the board, you get computer order entry of drugs in hospitals which could save up to 50 percent of medication errors in hospitals. This is in the Administration for Health Research and Quality report.

Britain, for example, has now bid having an electronic health record for every person in Britain. One of the people who designed that program, the head of Health Trio, which runs an electronic health record program for Brigham and Women's Hospital in Boston, estimates we could have an electronic health record for every American for about 10 cents per month per person. That is $28 million a month for the whole country to have an electronic health record, which would dramatically improve outcomes, dramatically improve accuracy, and would both save lives and save money, which seems to me ought to be the goal.

The third principle is to create a culture of quality. I will just give you two examples where the funding is perverse. Two million people a year get diseases in hospitals, 1.5 million a year get diseases in nursing homes. In other words, if you are in a hospital for more than four days, the odds are even money the hospital will give you a disease, which it will then charge you to cure.

But if you are a hospital that does a fabulous job, if you had a perfect record and nobody in your hospital got an additional disease, you would reduce the number of days of hospitalization, and you would lower your gross revenue, and you would end up losing money.

Now it is fairly easy to have CMS decide that the best 25 percent of all hospitals will get a bonus and to share with the hospitals one-third of the money they save the government. There is no question we can have a data base that statistically proves this. There is no question you could create the right incentives. But we do not today.

The same thing happens with the hip and knee surgeons. If you are a great hip and knee surgeon and you have a fabulous outcome and everything works perfectly, you actually get paid less than if you are an inadequate hip and knee surgeon. It is exactly the opposite. It is as though we paid for our Ferrari and we got a Subaru, and we paid for a Subaru and we got a Ferrari. It is exactly the opposite of a sound, intelligent system of using the market to create a culture of quality and to create a system of quality.

Last, if you really want an efficient health system, you want to rethink the health system from the ground up, from individuals

first, and then going to the patient, and then going to intensive care.

Let me make this clear. When we first started drafting Saving Lives and Saving Money, we talked about patient-centered care until we visited the Nestle's laboratories in Switzerland. Nestle's has over 150 scientists who work on nutrition every day.

They made the point that probiotics, the right important bacteria in your digestive system, is as important as antibiotics. You can invent, for example, a priabar that would be for osteoporosis. You can literally invent a health bar for diabetics.

Their argument is, and this is something that Dr. Zerhouni at NIH agrees with emphatically, that you can design a system that starts not with the patient, but it starts with the individual in a prediabetic environment, a pre-illness environment.

We are working with Novelli and Ortiz to design a national standard for diabetes. Part of that national standard would be to know that you are prediabetic and how you ought to change your diet and exercise before you ever become diabetic. If you are ever to become diabetic you have the ability to learn as early as possible before any damage is done to you, and to learn how to manage yourself to minimize the four great risks of diabetes.

I mention diabetes because it is the largest single health driver in Medicare. It is every seventh dollar of Medicare. Heart disease, kidney dialysis, amputation of legs, and blindness are the four major outcomes of diabetes. We should not undervalue this 17 million Americans are diabetic, and another 8 million are prediabetic. Unfortunately, the rate has gone up because of poor diet and exercise patterns in the country.

My point is that you want to think about aging from the standpoint of keeping the individual healthy as long as possible, incentivizing health, informing health, from taking care of self-management by the individual as a patient, and then going to traditional medical care. It is a very different model than the current system.

I will close with one example of what is clearly technically possible.

When I am out on the speaking circuit, I start the general audience by walking them through automatic teller machines, self-service gas stations with credit cards, and using Travelocity or Expedia or one of the Internet-based airline and hotel reservation systems. I do that to get audiences into the rhythm of realizing that in their daily life, they now do things that involve very sophisticated levels of information handling and they do it routinely and they do not even notice it.

Then I say, "Now let us talk about health where you get paper records, paper prescriptions, paper billing, et cetera."

I would hope that the Congress, as it looks at Medicare, would think of a 21st century model of the drug benefit. I will describe it very briefly. Based on the Travelocity model, it goes back to your market point. I really worry about going to a pharmacy benefit manager model where you are going to have aggregated purchasing by third parties, rebates becoming kickbacks in political language, an ensuing chaotic mess.

What I would recommend is that you go to the doctor with a Travelocity model of Medicare benefit in mind.

If you had a very rare disease or a very rare genetic circumstance, the doctor would give you the precise prescription for one drug only. The government should then figure out what it is going to subsidize that purchase. But in most cases, particularly for chronic illnesses and for things that are not tremendously acute, what you are going to get is a prescription for a class of drugs. This is how the whole pharmacy benefit management model works, where you have $10 co-pay, $20 co-pay, or $30 co-pay.

I would reverse the system. The doctor and you should have access to a Travelocity-style page where you see every drug available for that particular problem. I would include medically appropriate over-the-counter medicine. It is absurd to take Claritin, which was one of the most widely prescribed drugs in the country until it went over-the-counter the second the price crashed, we do not count it as a medical expense. We are incentivizing high cost and then act shocked that we get high cost.

The current system encourages the pharmaceutical company to have the highest possible price so they can offer the biggest rebate to the pharmacy benefit manager so that they then have a lower-price based on this. It would be like going into a car dealership and being told we have a $600,000 Ford, but for you Senator Craig, we will give you a $560,000 rebate, so you are getting a $40,000 purchase. Don't you feel good about that rebate? That is how the drug business is today. It is totally backward.

What ought to happen is that the senior citizen, in consultation with the doctor and with their pharmacist, could pick any drug out of this list and the government ought to finance 100 percent of the least expensive drug. Then make that dollar value available on an open formulary for anybody else to buy any drug they want.

So if you saw the commercial last night, fell in love with it and were convinced, and you want to put up $150 bucks out of your own pocket, it is your right as an American.

But if you decide you need an effective—and again, medically effective, quantitative data analysis based, FDA and NIH supervised medically appropriate, least expensive drug, your government will pay for all of it.

Now, if you want to have a range of choices, fine. We should not restrict you. I just suggest you look and think about that.

That would be a market-oriented system that would teach the drug companies to worry about the value of their drugs, teach them to have an end-state price, would teach the individual to look at what their choices are and make the choice, and dramatically increase the range of freedom and most importantly be the right step toward a Medicare for the baby boomers—that allow the baby boomers to have control of their own lives.

[The prepared statement of Mr. Gingrich follows:]

**Testimony of**
**Former Speaker of the House**
**Newt Gingrich**

**For**

**The United States Senate**
**Special Committee on Aging**

**The Future of Human Longevity**
***How Markets and Innovation can Transform Medicare***
**FINAL**
**Tuesday, June 3, 2003**

Thank you Mr. Chairman, Mr. Breaux, and distinguished members of the Committee. I am delighted to have the opportunity to present testimony before this Committee on this very important issue.

Historically, there is a clear link between prosperity, health, and longevity. Wealth is required for investment in discovery, invention, and innovation, which creates a beneficial cycle of even greater prosperity and wealth. Without the scientific research of the last sixty years, we would most certainly have lower incomes, lower standards of living, and fewer choices. This cycle of prosperity increases labor-saving devices and reduces disabling conditions, enhances diet and nutrition, improves medical diagnosis and treatment, and promotes innovation.

In health and healthcare, it is particularly important to increase our public and private investment in research. If America invests in scientific knowledge—not just in direct medical research but also in physics, mathematics, chemistry, and engineering that are the underpinnings of so much of our advanced biological knowledge—we will extend life to an even greater degree, minimize suffering, and create a healthier and less medically expensive America.

We stand at an incredibly important moment in history. We are at the dawn of an explosion of knowledge that will change everything we know about science and, therefore, the human body. We will exponentially grow our knowledge of biology, physiology, and other health sciences in ways that will profoundly change the practice of medicine. The fields biotechnology and nanoscience did not exist 30 years ago. Driven by these two field and computing, I believe that the knowledge breakthroughs of the next twenty years will equal to that of the entire 20$^{th}$ century.

The importance of these fields cannot be overstated. It will affect almost every aspect of our lives, from the medicines we use, to the power of our computers, the energy supplies we require, to the food we eat, the cars we drive, the buildings we live in and the clothes we wear.

The word "nano" means one-billionth and nanoscale is the space between one atom and about four hundred atoms. It is the space in which quantum behavior begins to replace the Newtonian physics you and I understand. The same laws of physics literally do not apply in the nanoworld.

In this world of atoms and molecules, new tools and techniques are enabling scientists to create entirely new approaches to health. Nanotechnology allows us to "grow" materials by literally adding the right atoms and molecules to one another. The possibilities for adding years to human longevity from the confluence of biotechnology and nanotechnology are simply staggering compared to even today's latest medical innovations.

One example is that nanotechnology makes possible the ability to grow molecular "helpers." For instance, we may be able to develop anti-cancer helper molecules that penetrate human cells without damage and hunt cancer at its earliest single cell development. Imagine drinking your orange juice with three million molecular rotor rooters to clean clogged arteries without an operation.

Not only does nanotechnology open up our understanding of biology, but also biology teaches us about the nanoworld, because virtually all biological activities are at a molecular level. Thus, our growing capabilities in nano-tools and nanohelpers will dramatically expand our understanding of biology while our growing knowledge about molecular biology will expand our understanding of the nanoworld.

Dr. Sam Stupp is a world-class expert in using nanomaterials uses molecular design to create self-assembling systems at the very basic levels of assembling atoms and molecules. In effect, he is studying how nature assembles the very basic components of our body.

Since we can now work literally at the scale of single molecules coming together to form structures by design, we are beginning to learn how nature pieces together extraordinarily complex systems. As we learn to repeat the same process, we can begin to regenerate lost parts of our body.

Imagine that a blind person could regenerate their retina and literally have a new organic retina made of precisely the same material as their original retina. Imagine that a person in an accident who had lost the use of their arms and legs due to compression of the spinal cord could suddenly regenerate their spinal cord and have new use of their arms and legs as though the accident had never occurred. Imagine that someone with a bad heart could grow new, healthy heart tissue instead of having a heart transplant.

Far from science fiction Dr. Stupp believes all these breakthroughs could begin to occur by 2015.

Given these breakthroughs we are likely revolutionize the way we deal with a large number of problems involving injury, illness, and aging.

Great breakthroughs are occurring in large established companies as well as small startups. For example, The Nestlé TM Research Center in Switzerland is one of the largest and most sophisticated private laboratories of its kind in the world. The scientists at Nestlé TM have a very wide, and at times somewhat different, perspective on the importance and impact of nutrition on health. In addition to their interest in normal body cells, they also have a keen interest in the 70% of the cells in your body that are not "you." Our bodies are hosts for billions of tiny beneficial bacteria that live

in our small and large intestines. These organisms, referred to as probiotic organisms, help us stay healthy by, not only altering some metabolic processes in the intestine for the better, but also by competitively inhibiting attempts at colonization of the intestine by harmful bacteria.

Consequently, these probiotics act as a protective barrier for our bodies. The food you eat influences the numbers of these beneficial probiotic bacteria in our intestine in a way we are beginning to understand. As a result, they have developed a yogurt that delivers these beneficial bacteria to the intestine in a way that is both inexpensive and practicable. Once in the intestine, the probiotic bacteria can then actively play out their beneficial role. The implications for health management and disease prevention are amazing.

There are other stunning breakthroughs now occurring in biology. Breakthroughs, including the now completed Human Genome Project, will teach us more about the human body in the next twenty years than our total knowledge in history to this point. Now that we have finished documenting human DNA, Dr. Crick, the Nobel Prize-winning, co-discoverer of DNA, thinks it will take us a century to understand and apply all the potential breakthroughs this new knowledge makes possible. It is conceivable that in the not-so-distant future it may be possible to design an exact drug concoction specifically for you and your condition based on your genetic code.

The development of new technologies will increase our understanding of the human brain in ways previously unimaginable. Perhaps ironically, these will be largely a function of physics and mathematics because we are discovering that the brain may be

one of the most complex aspects of the entire universe. From Alzheimer's to Parkinson's to schizophrenia, there will be virtually no aspect of our understanding of the human brain and human nervous system that cannot be transformed in the next two decades.

Yet, the greatest obstacle to making today's technology—much less, tomorrow's technology—accessible to America's seniors is Medicare. There is much to be done to improve the quality of life and longevity of Americans. And I believe the effort to strengthen and improve Medicare has the potential to harness market forces and make available past medical discoveries as well as future medical discoveries. The demographic, social, and technological history that follows will set the stage for transforming Medicare—based on market competition and increased choices for seniors. Correctly designed, Medicare can play a positive role by enhancing longevity and improving the quality of life for older Americans.

Fifty-seven years ago something began to happen every 8 seconds -- the baby boomers were being born. In the very near future, they will begin to retire at a similarly rapid rate.

It is a testament to American innovation and values that we are living longer. Our ability to extend life is no doubt a great success but one that presents to us, and to this Committee in particular, some enormous challenges. We must face the reality that 76 million baby boomers are nearing retirement and consider how their retirement will affect the future of Medicare and Social Security.

The pattern of thought when confronted with such emerging demographic realities has historically been to set up command and control structures to limit access and to restrict choice in an attempt to control costs. These methods have routinely failed us in the past, and there is no reason to believe that they can succeed in the future. And if attempted will, I believe, lead to higher costs, severe cuts in benefits, and dramatically lower the quality of care which will lead some to suggest raising taxes to prop up a fundamentally broken system. The result will be an expensive and inefficient program that will be incapable of delivering quality care at an affordable price.

As a fair warning to all elected officials, baby boomers are the least likely group to accept being trapped into a bureaucratic, red-tape-ridden, regulatory, third-party-payer system with fewer choices, lower quality, and increasing costs.

What boomers already understand is that the natural pattern of the 21st Century is to have more choices and greater quality at lower cost precisely because these choices have been their experience over their entire lifetimes. Thanks to modern technology and science in an entrepreneurial market-oriented system, they have come to expect better products and services at the lowest possible price. In fact, they know that as quality improves, prices often decrease. This is true of many of the products and services they use daily including mobile phones, computers, online travel services, automatic teller machines (ATM), and even self-service gasoline pumps.

As they age they will begin to use the healthcare system more and more. What they will expect is what they have always received – high quality at low costs. What the members of this Committee should understand is that with their background it is

impossible to talk to baby boomers about rationing, about scarcity, about limited choices or ask them to accept skyrocketing costs. Implementing such reforms, in my view, will guarantee that the system will fail and that failure will cause enormous pain.

I believe that to positively reshape government's role to affect best possible outcomes in health, we must first be honest about, and accept how obsolete the current model is, and acknowledge that what is required is to rethink Medicare from the ground up. To get agreement on this point, let me provide some historical context.

Medicare was created in 1965. Since then:

- **In 1967, the first liver transplant was performed.**
- **In 1968, the first heart transplant.**
- **12 years after Medicare was created, the MRI was invented.**
- **The cellular phone and the Walkman came along in 1979.**
- **ATM's, bar code scanners, VCRs, fax machines, and personal computers were invented.**
- **In 1980, the Hepatitis B vaccine was invented.**
- **17 years after Medicare, the first person received an artificial heart.**
- **The Windows program was released in 1985.**
- **25 years after Medicare, the World Wide Web protocol was created.**
- **Lipitor, a drug to control cholesterol, became available in 1997.**
- **Actonel, a drug to treat osteoporosis, in 1998.**
- **Celebrex for arthritis in 1999.**
- **Reminyl for Alzheimer's patients in 2001.**
- **Diovan for high blood pressure was made available just last year.**

Today's Medicare, essentially the same program since 1965 based upon 1960's science, medicine, and technology, is simply outdated. Moreover, its command and control

structure is exactly what we would advise every other country in the world against doing.

Remember in 1965, the average life expectancy was 70.2 years of age. Today it is 77.2 and is expected increase to 78.5 years of age by 2010. Bill Novelli, President and CEO of AARP said, "Baby boomers want a second start, not a retirement." Baby boomers will spend more years in retirement than any other generation, so in thinking about longevity for the baby boomers and their children, we should recognize that boomers have a very different idea about retirement than their parents did. They will want to make their lives in retirement even more interesting and productive. They are very likely to be more active and as they are accustomed, they will want to be in control. They will not sit passively while others make decisions about their lives. Baby boomers are the most market-oriented and savvy generation to reach retirement in American history. They understand investing, modern technology, and communication. Government should get ahead of the wave by adapting, in parallel, to the realities of this modern and demanding generation.

So can we transform Medicare? Historically, I am an optimist. I believe we have a window of opportunity to provide all our seniors with the choices and quality they deserve and indeed will demand at the lowest possible cost. I came here today because I believe that we can transform Medicare into the 21st Century model that I have described.

In order to significantly transform Medicare, we must constantly strive for innovative entrepreneurship. I want to share with you an outline of how markets and innovation

could truly saves lives and save money by applying four major drivers of change to create a 21st Century Medicare or "BetterCare," if you will, because our goal must be to provide the best possible care not only for the baby boomers but for each subsequent generation.

- **First** -- Focusing on Patient Safety, which will provide the moral authority for transforming the system.
- **Second** -- Building an IT system characterized by increased accuracy, speed, efficiency, and ability to focus on outcomes with genuine privacy.
- **Third** -- Developing a culture of quality in the Deming and Six Sigma models.
- **Fourth** -- Insisting that the individual take personal responsibility for his or her own health.

A solution's transformational value in any of these four areas should be measured by its ability to achieve one of the following results:

1. Better health or healthcare outcomes at lower cost.
2. The same health or healthcare outcomes at lower cost.
3. Better health or healthcare outcomes at the same cost.
4. Life saving measures at any cost as an American value.

I want to take a moment and share with you what I think are the key principles of a 21st Century System of Health and Healthcare that should be applied to Medicare.

They are:

Centered on the Individual
Values Driven
Knowledge Intense
Innovation Rich
Prevention Focused
Electronically Based
Market Mediated

Moreover, they should:

Increase Choice
Improve Quality of Care & Quality of Life and
Drive Overall Costs Down

None of the five life-changing drugs that I previously mentioned as examples were available before 1997. In the modern medical world, it is no longer acceptable to separate healthcare from modern pharmaceuticals. Drugs have become an indispensable part of modern healthcare and central to health, so much so that as a vital first step in transforming the system from its 1965 roots, Congress should allow seniors to get the drugs they need by adding a prescription drug benefit to Medicare. However, in doing that, it should also use its market power to demand increased patient safety and administrative efficiency by implementing two solutions that will result in better quality at lower cost -- electronic prescriptions and an electronic Internet-based drug-purchasing system. An Internet-based, market-oriented, drug-purchasing system would give seniors the widest range of choices with the most information at the lowest cost to them and to the government.

As Congress considers a Medicare reform bill, every member should keep in mind the world in which I have described and indeed the world we all live in -- where consumer-based systems handling millions of transactions daily are in real-time, available 24/7 and are amazingly accurate. So accurate, in fact, that many consumers no longer get a receipt for their electronic transactions as in the case of gasoline purchases. Consumers are so confident that a gas pump anywhere in the country (except New Jersey and Oregon) will be so fast that they do not even think about the two seconds it takes for the credit card to turn the pump on, so accurate that it is not worth reconciling the transaction with their credit card or bank statement, and so safe that they are willing to have their personal financial information travel through an electronic network to take money from their personal account. This is a gas pump.

But then, quite literally, just across the street, we meet our healthcare system where sick patients are routinely expected to fill out multiple forms with the same information that they have been asked to fill out numerous times before. A healthcare system in which the Institute of Medicine reports that we lose at least 44,000 Americans every year due to medical errors, the equivalent of a New York to Washington airline shuttle full of passengers crashing every day killing everyone on board. If we were losing a shuttle every day, we would be frantic because we take the lives of airline passengers very seriously. Our current healthcare system tolerates 2 million hospital-induced illnesses a year. That is, if you spend more than four days in a hospital the chances are even money that the hospital will give you a disease for which the hospital will then charge you to cure. In a quality system (driver of change number three) we would focus on reducing those illnesses by at least 90%, thus saving 1.8 million people from getting a

secondary illness. That alone would save an enormous amount of money not to mention suffering and death.

Moreover, in the healthcare system today, doctors continue to write billions of handwritten prescriptions every year of which more than 150 million require a call-back from the pharmacist to the doctor for three basic reasons: the pharmacist cannot read the writing, the drug is not compatible with another drug the patient is taking, or the pharmacist wants to substitute a drug so the patient's insurance will cover it. That is an enormous waste of time and resources for what is a correctable problem. But more importantly, written prescriptions kill people because with billions of written paper prescriptions, errors are going to happen. Yet, while nearly all physicians' offices have computers and 75% of doctors own a hand-held computing device and even with the technology readily available, according to a 2002 Harris Survey only 16% of office-based physicians are using electronic prescribing tools and only 2% to 3% of the more than 3 billion prescriptions dispensed annually system-wide are currently processed in an electronic format.

The evidence that written prescriptions kill people is overwhelming.

Medication errors contribute to more than 7,000 deaths annually, exceeding those resulting from workplace injuries, yet we have no OSHA-like response.

According to a report by the Institute for Safe Medication Practices, medication errors could be cut by 55% if physicians switched to electronic prescriptions. But this is more than a theory, a computerized physician order entry system at the Metropolitan Hospital

Center in New York helped reduce medication errors by more than 40%, while incorrect drug orders fell by 45%, and illegible orders all but disappeared.

Following the installation of a computer prescribing module at Oregon Health and Science University Hospital emergency department, prescriptions were three times less likely to include medical errors and five times less likely to require pharmacist clarification than handwritten prescriptions.

A survey of 400 physicians found that 76% said electronic-prescribing technology enabled them to deliver better quality care.

Electronic prescriptions are proven to increase efficiency.

A study by Tufts Health Plan found that electronic prescribing saved two hours a day per physician. In addition, the technology helped doctors improve patient safety in several ways: it made prescriptions more legible, it let them know of potential drug interactions, and it let doctors know whether patients had been refilling their prescriptions on time.

A study by the University of Virginia found that e-prescribing devices cut prescription refill times to an average of 69 seconds, down from the 15 minutes that nurses had to wait on hold before their orders were taken.

Within three months of implementing a new e-prescribing platform and improved training procedures, inbound pharmacy calls fell 36% and outbound calls to manage

renewals fell 50%, according to a recent study on the impact of electronic prescribing technology. Financial savings equated to approximately $3,000 per physician per year.

Temple University Health System Primary Care Physicians saved 10% on malpractice insurance premiums after installing an electronic prescribing system.

Let me say for the same reasons I just outlined, and because building a real-time, accurate, efficient health IT system is the second driver of change, we should move to a secure medical records system and encourage all digital environment hospitals such as the Indiana Heart Hospital recently featured on the Today Show. These systems allow doctors to access with your permission and without your permission in an emergency, your complete health history including any allergies you might have and the medications that you are currently taking.

We can no longer accept suffering and death because of prescription errors or any other preventable errors. As I indicated, patient safety must be the first driver of change. We should set the same standard of safety for the patient as we do for the passenger on an airplane. From an economic standpoint, we should not tolerate the current inefficiencies in the Medicare system but instead build a culture of quality, which is the third driver of change. Congress should move to mandate electronic prescriptions by 2005. A good first step after passing a Medicare Drug Benefit would be to not reimburse handwritten prescriptions. That would save both lives and money.

In addition to incentivizing e-prescribing, Congress should create a prescription drug purchasing system that optimizes the beneficiary's choice of drugs while minimizing the

cost and maintaining a fair market price that will not stifle future research and development of new drugs. This system should be based on the hallmark of all systems that deliver value -- the power of the market. With the advent of the Internet, competition has never been as fair because information has never been so transparent. I propose that CMS create an electronic prescription-drug comparison system for seniors that is modeled after some of the most empowering technology that consumers have ever seen.

The model I am describing is not unfamiliar to any of you. I suspect that all of you use an automatic teller machine or have used a self-service gas pump that accepts your credit card, or you might use one of the online travel services such as Travelocity, Expedia, or Orbitz. If so, you will instantly understand this model. But first we need to dispel the notion that Americans are not able to learn new technologies that help them to manage their lives, because the opposite is true.

> 64% of consumers as of last year have an ATM card resulting in 40 billion transactions a year globally.
>
> 94% of consumers that have begun the car shopping process have conducted online research while only 67% have visited a dealership in person.

All the evidence from Internet-based price comparison tools like Travelocity and Expedia indicate that buyers get lower prices by shopping online. Various studies indicate average cost-savings range from 9% to 16% on books (Jules Kaplan, University of Colorado), 28% on prescription drugs (Jules Kaplan, University of Colorado) 10% or

higher on airline tickets (Thomas Weisel Partners), and 40% on automobile insurance (Daniel Finnegan, Quality Planning Corporation). Buyers' access to Web-based price comparisons has been responsible for at least ¾ of the 20% industry-wide reduction in the cost of life insurance policies. Finally, while there is generally the absence of a binary (buyer-seller) healthcare market in America, a recent study of cosmetic surgery, which is one of the few areas in healthcare with a binary market, indicates that markets do work. The price of cosmetic surgery rose 16% since 1992 compared with a 47% increase in the price of medical services and a 26% increase in the Consumer Price index in the same time period (NCPA issue brief 437, http://www.ncpa.org/pub/ba/ba437/).

The same electronic approach can help individuals manage their health if they have a chronic disease like diabetes by giving them the latest information to keep them as healthy as possible. No doctor or nurse can manage a person with diabetes successfully. The individuals must do it for themselves every day, and if they do, they can dramatically improve their chances of not suffering nerve damage, blindness, lower-limb amputation or kidney loss. Not only would that save suffering but it also would save millions of Medicare dollars currently spent on diabetic illnesses. When we passed welfare reform, we insisted that people go to work or go to school. So now we should feel comfortable insisting that every American, rich or poor, take control of their own health and their own healthcare dollars, which is the fourth driver of change, but we have to give them access to the right information.

How do we propose to accomplish this?

Our goal is to have an online system that would allow doctors and senior citizens to have access to the full range of drugs and prices that would apply to their situation. The government would then subsidize 90% to 100% of the least expensive drug and would apply the same dollar value to any of the more expensive drugs. The consumer who chooses a more expensive drug would pay the difference. If you had a unique need, the doctor could prescribe the one medication you need, and the government would then subsidize it.

Assume you went to the doctor and the doctor gave you two prescriptions. One prescription was for a unique one-of-a-kind drug that has no real alternative for your medical condition. The other prescription was for a drug that exists in a class (the base of tiering and formularies in the current PBM model). In the first case you get exactly the one-of-a-kind drug the doctor prescribed, and the cost of the drug is subsidized to the degree the government (Medicare) or the employer has agreed upon. So far, nothing is dramatically different from the current system although the price pressure even on a unique drug would be much greater in a "Travelocity-based system" than it is in the current system. (Outside of America, reference pricing in Germany, Australia, etc. indicates that the price pressure once you are in a class of drugs is inexorably and rapidly downward toward the least expensive.)

For the second drug the individual would use the electronic prescription-drug comparison system on their computer, at a kiosk in their drug store, or by using an 800 number where they would learn that there are seven drugs in this group, including medically appropriate over-the-counter drugs. The government would pay either 90% or 100% of the least expensive drug. For ease, we will say that the government pays

90% of the least expensive drug. In this case, the least expensive drug is $50 so the government is going to pay $45, no matter what drug you choose. If the drug you want for your own particular personal reasons is $60, the government is still paying 90% of the lowest-priced drug, $45. So, if the consumer purchases the $60 drug they will pay $15. But the key is that they have the information and they have a choice. Choice creates competition and competition drives down price.

This system could also be used for employer-sponsored insurance with your employer paying a percent of the lowest-price drug. There is an open formulary and again the choice is up to the individual.

Imagine having the National Institute of Health and Food and Drug Administration develop an outcomes-based, data-rich system with a nightly tracking of real prices paid. This is doable according to Walter Hoff of NDC Health, which handles 10 million drug transactions a day. With this model you are getting a market-centered science-based system of guaranteeing access to the lowest-cost drug while creating downward market pressure.

Under this new system, seniors would be better off than they are now because the government would pick up virtually all of their least expensive choice. If they wanted to spend more they could, but it would be their choice and their money, all of which is consistent with the principles of a free-market society. In this model there are no bureaucratic controls, no drug company is having its product stolen by confiscatory pricing, and people have access to the medicine they need. However, in this model the

price pressure is relentlessly downward, and the drug company has to decide what price it needs to charge to be competitive.

A cardiologist in Chicago has already created a similar system called Rxaminer. Rxaminer allows patients to go online, find lower-priced equivalents for prescribed drugs, and then take that information to their doctors to discuss whether the lower-priced options are feasible. According to Rxaminer, the usual result is a 20% to 40% cost savings. This can be even greater if the patient then goes to various online drugstore Web sites to compare prices for the selected lower-priced option, which Rxaminer says can reduce prices by another 10%. As an example of the price saving opportunities that exist, a survey posted online by the State of Arizona shows an amazing price variation within that State for the very same prescription drugwith some of these variations as high as 700% (www.attorneygeneral.state.az.us).

This system would make transparent a very complicated system and specifically affect the current practices of pharmacy benefit managers (PBM) and pharmaceutical manufacturers. In essence, it would be the end of the rebate schemes, the end of "AWP minus," the end to the third-party-decision mess that currently makes it impossible to know what drugs truly cost. For example,

1. It would transition PBMs from being managers to truly only being pharmacy benefit administrators.

2. The drug companies would have to list true prices and there would be no rebates. The PBM would make its money on transaction fees rather than on rebates.

3. The doctor and patient would be making the decision based on real information about price and efficacy rather than on formulary tiering.

4. There would be an open formulary with the government financing the least expensive, unless the doctor designates a unique drug rather than a negotiated formulary with rebates.

In addition to the cost-lowering benefits of true competition, the combination of electronic prescribing and an electronic system of drug comparison would have additional advantages:

> With electronic prescribing and electronic comparisons and purchasing we could begin to develop outcomes-based data with massive statistical data bases in the near future. Companies like Anceta are actually working on this for medical groups like Mayo.
>
> Even within the model of making available one-of-a-kind drugs, we could track all doctors' prescriptions so we could identify which doctors were practicing unnecessarily expensive medicine as opposed to doctors who were practicing best outcomes, not lowest cost.

The key to making a prescription-drug benefit work is an educated doctor and an educated patient who possess the knowledge and the incentives to make outcome-based choices. This is the key to creating a better, healthier, more financially stable system.

I think this is exactly the right hearing and comes at exactly the right time. An improved health status and an increased longevity of older Americans depend greatly on what the Congress does to incorporate new and emerging technologies, especially prescription drugs, into the Medicare program. Congress has the immediate opportunity to skip past all of the failed techniques of the 1980's and 1990's and develop a 21st Century Medicare Drug Benefit. We can learn from the mistakes of managed care, which never managed care at all and also failed at managing costs, and we can learn from the mistakes of the highly convoluted rebate-ridden and totally-impossible-to-understand current pharmacy-benefit management system. Armed with that learning and with the incredible breakthroughs and technologies inherent in today's age of transformation, we can create a 21st Century Medicare System of improved health status, lower disability rates, better quality, lower cost, and increased longevity for all Americans.

Thank you.

The CHAIRMAN. Mr. Speaker, Congressman, you have challenged us once again. That is why I was excited when we found you would be available to come with this panel today to visit about the innovations in the marketplace, the thinking you are doing, and the work you are doing with others.

Before we turn to our other two panelists, let me recognize colleagues that have joined us today, and ask Senator Stabenow, do you wish to make any comment before we resume the panel?

Senator STABENOW. Thank you, Mr. Chairman. Welcome to a former colleague in the House of Representatives. It is a pleasure to have you with us.

The CHAIRMAN. When I was in the House, Senator Carper was there, along with Congressman Gingrich, and we worked together on many issues.

Senator CARPER. I do not know that we are the three amigos, but sometimes we were.

The CHAIRMAN. On occasion.

Senator CARPER. Maybe on some of these issues we can be again. Newt, it is great to see you. Thank you for joining us.

To our other witnesses, we are delighted that you are here, and we look forward to your testimony. Thank you.

The CHAIRMAN. Thank you both.

Now let me turn to Dr. Richard Hodes, Director of the National Institute of Aging. Doctor, welcome. We are glad to have you with us today.

**STATEMENT OF RICHARD HODES, M.D., DIRECTOR, NATIONAL INSTITUTE ON AGING, BETHESDA, MD**

Dr. HODES. Thank you, Mr. Chairman, and members of the committee for the invitation to speak to you about longevity and innovation in aging research.

As the Chairman mentioned, and as Mr. Gingrich reinforced, we are really living in an era of unprecedented longevity, as well as quality of life in which more and more Americans and citizens of the world live not only longer lives but lives that are robust and high-quality. Longevity has increased from around 1990 where the life expectancy in this country was about 49 years of age, to the current time when we are in the high 70's and approaching 80, facts we will hear a good deal about in the demography session to follow this.

However, there remain great challenges to those in older life, challenges of disease and disability. These challenges will be addressed by new areas of technology. Some of them we have heard mentioned, nanotechnology, computational biology, proteomics, genomics, and I hope to share with you in these next few moments some examples of these.

It is urgent that we apply such technologies to early diagnosis, to identification of people at risk, and ultimately to the installation of favorable behaviors, to engender lifestyles that will minimize disease and disability.

In the examples that I would like to share with you today, I think we see on the horizon the outcomes of an ever accelerating degree of discovery, which I agree with the previous speaker, really

bodes well for the future if we are only able to apply the success of research in a variety of areas.

Let me begin with some examples. One of the most intriguing areas of research in longevity is that which deals with the role of genes in life expectancy and longevity. This is research which has proceeded in a variety of species ranging from yeast to worms to flies, ultimately with application to humans.

What is illustrated here is one example, in the graph to the right, which shows you the life expectancy of C. elegans, a worm. You can see what is plotted here is the number of the population that survive at various ages.

In the first curve, that falls off to the left, you can see that about 50 percent of animals have died by about 2 weeks of age. Some live as long as 20 days. But the remarkable finding illustrated here is that mutation in a single gene of the 17,000-some-odd genes in this species results in the curve you see to the right, a shift which is equivalent to a doubling or tripling of life span.

Moreover, if one looks at the table to the left, one can see this is only typical of a variety of mutations that have this kind of effect. Importantly, they teach us something in that they fall into defined and understood pathways of metabolism. In this case, for example, pathways that have homologs in the human and relate to insulin and insulin-like receptors. So they point the way toward the biology of human behavior, disease and open avenues to understand what determines longevity, absence of disease, and multiple targets for future interventions.

In addition to research aimed at longevity itself it is critical that we address some of those disease which still challenge both lifespan and quality of life, and I would like to address just briefly examples from two of those arenas. The first that I will touch upon is the area of neurodegenerative diseases. These are diseases such as Alzheimer's disease and Parkinson's, which take a terrible toll on those who are affected, predominantly those in older age.

Much of what we have learned about the diseases has come from technical innovation. One of the innovations that has been most exciting is that of imaging. So we have learned, and many of you are aware, that techniques such as MRI or PET scanning allow us now to have structural and functional insights into what goes on in the brain, including the human brain.

Illustrated here are some recent findings, yet to be published which illustrate a new technique in which a gene has been engineered that acts as a reporter. So that when cells and parts of the brain are damaged by an insult, they actually induce a product which causes the emission of light, a luminescence that can be detected by cameras very sensitive, models like those used to detect light from stars at great distance.

What you see here is actually the colored image of damage to brain cells caused by, in this case a chemical insult, that makes it possible to study both the normal biology of brain, the effect of insults, ultimately the effect of interventions designed to reverse or prevent damage to nerve cells. All this in a living animal and hopefully therefore technology that will be translated to understanding of the human condition and human disease.

The second area mentioned moments ago that is an enormous cause of disability and disease is that of obesity, secondary in large measure to behavioral changes in the population and responsible for a good deal of the morbidity associated with diabetes, heart disease, and cancer.

What is illustrated here is yet another new technology, that of using RNA interference, in which types of RNA are capable of neutralizing the messages which are encoded by each of the genes in an organisms' genome or chromosomes. This experiment was conducted using such a technique in understanding what influences the regulation of fat metabolism and obesity.

In this case, every one of the 17,000 genes effectively was neutralized and the effect of each of these events plotted. As you can see, the discovering here was that some 305 genes, when inactivated, caused a decrease in fat. That is decrease in the red staining you see. Some 112 genes, when inactivated, caused obesity, again providing now multiple targets for our understanding of this important public health problem and our opportunity to address it.

These examples pose a reason for being optimistic of our ability to maintain not only the extension of longevity that has been evident over the past years, but to do so in a way that minimizes disease and disability.

I thank you, Mr. Chairman and members of the committee, for holding a hearing on this very important subject. Thank you.

[The prepared statement of Dr. Hodes follows:]

**Testimony**
**Before the Special Committee on Aging**
**United States Senate**

# Human Longevity and Aging Research

*Statement of*
## Richard J. Hodes, M.D.
*Director*
*National Institute on Aging*
*National Institutes of Health*
*U.S. Department of Health and Human Services*

**For Release on Delivery**
**Expected at 10:00 AM on**
**Tuesday, June 3, 2003**

Mr. Chairman, Senator Breaux, and Members of the Committee:

Thank you for inviting me to appear before you today to discuss human longevity and innovations in the field of aging research. I am Dr. Richard Hodes, Director of the National Institute on Aging (NIA), and I am delighted to be here today to discuss this important topic.

*Life Expectancy*

Today, more people than ever before are enjoying robust health and productivity well into their seventies, eighties, and beyond.[1] Life expectancy for Americans, around 49 years in 1900, has increased over the past century to about 76, thanks to improvements in health care, nutrition, and the overall standard of living for most people. Furthermore, demographic projections suggest that life expectancy for men and women who maintain the healthiest lifestyle patterns will continue to increase. In fact, centenarians (persons 100 years of age and older) are the fastest-growing segment of our population.

As importantly, Americans are not only living longer, but also remaining healthier and more active well into older age. A recent meta-analysis of demographic studies confirms that disability among America's elders has declined steadily over the past decade.

More older Americans are able to participate in "instrumental activities of daily living," such as performing household chores and managing their own medications, while fewer are experiencing limitations in basic physical tasks such as walking or climbing

[1] Federal Interagency Forum on Aging Related Statistics. *Older Americans 2000: Key Indicators of Well-Being.* 2000.

stairs. The prevalence of severe cognitive impairment also appears to be declining, although this finding needs verification by additional study.

At the same time, diseases of aging continue to affect many older men and women, seriously compromising the quality of their lives. For example, more than half of all Americans over age 65 show evidence of osteoarthritis in at least one joint.[2] Over half of Americans over age 50 have osteoporosis or low bone mass[3]. Cardiovascular disease, cancer, and diabetes remain common among older Americans. And, according to the Alzheimer's Association, as many as 4 million Americans suffer from Alzheimer's disease (AD), the most common cause of dementia among older persons.

At the NIA and other Institutes and Centers at the National Institutes of Health (NIH), we are working to understand factors that affect human longevity and ways to improve quality of life. We know that to prolong life we must improve diagnostic methods to ensure early and reliable detection of disease and pathology; we must encourage individuals to make healthy lifestyle choices; and we must develop effective interventions for disease and disability.

We anticipate that our efforts to reach these goals will be influenced by findings from a number of emerging technological fields, including medical imaging, computational biology, proteomics, regenerative medicine, and even nanotechnology. The NIH is currently supporting research in all of these areas in the context of the NIH Roadmap initiative to enhance research infrastructure and methodology.

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[2] See "Handout on Health: Osteoarthritis," National Institute of Arthritis and Musculoskeletal and Skin Diseases, July 2002

[3] See America's Bone Health: The State of Osteoporosis and Low Bone Mass in Our Nation. National Osteoporosis Foundation, February 2002.

*Longevity Research*

An intriguing area of investigation is the analysis of genetic contributions to longevity. **(Chart #1)** Research findings indicate that similar mechanisms and pathways regulate longevity in diverse species, including yeast, fruit flies, nematodes, and mice, and that equivalent mechanisms and pathways may exist in humans. In 1993, NIA-supported researchers formed the Longevity Associated Gene (LAG) Initiative in order to identify genes and processes involved in longevity regulation across species. The ultimate goal of the LAG initiative is to relate findings in other species to the regulation of human biology, contributing to identification of age-related changes in physiological systems. Other studies, including the NIA-supported New England Centenarian Study, are identifying genetic and other factors that contribute to successful human aging. In the Centenarian Study, data on 444 centenarian families and over 2,000 siblings will provide information on factors that support extreme longevity and will suggest directions for future research.[4] **(Chart #2)**

In addition to studies of possible genetic influences on longevity, NIA supports and conducts extensive research on diseases and conditions that often shorten life, or that seriously compromise the quality of life of older Americans.

Two conditions that illustrate the ways in which advances in technology are leading to new findings that may both extend life and improve overall quality of life are Alzheimer's disease (AD) and obesity.

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[4] Perls, T.T., et al. Life-long sustained mortality advantage of siblings of centenarians. *Proceedings of the National Academy of Sciences. 2002* ;**99**(12), 8442-7.

*Alzheimer's Disease*

AD is a devastating condition with a profound impact on individuals, families, the health care system, and society as a whole. According to data from the Alzheimer's Association, approximately 4 million Americans are currently battling AD. Moreover, the rapid aging of the American population threatens to increase this burden significantly in the coming decades: Demographic studies suggest that if current trends hold, the annual number of incident cases of AD will begin a sharp increase around the year 2030, when all the baby boomers (born between 1946 and 1964) will be over age 65. By the year 2050, the number of Americans with AD could double.[5]

We have made, and are continuing to make, considerable progress in our ability to diagnose, treat, and even prevent AD, and advances in imaging technology have played an important role in each of these areas. The development and refinement of powerful imaging techniques that target anatomical, molecular, and functional processes in the brain is giving us an improved ability to identify people who are at very high risk for AD, as well as a greater understanding of the disease's pathology. For example, recent studies suggest that positron emission tomography (PET) scanning of metabolic changes in the brain and magnetic resonance imaging (MRI) scanning of structural brain changes may be useful tools for predicting future decline associated with AD and other neurodegenerative diseases.

Several new findings in mouse models illustrate the promise of advances in imaging technology. In one study, researchers found that changes in brain structure can be

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[5] Hebert LE, Beckett LA, Scherr PA, and Evans DA. Annual Incidence of Alzheimer Disease in the United States Projected to the Years 2000 Through 2050. Alzheimer Dis. Assoc. Disord. 15: 169-173, 2001.

detected by magnetic resonance microscopy before AD's characteristic amyloid plaques appear in the brain, suggesting that subtle pathologic changes are occurring long before signs and symptoms of the disease appear. In another study, investigators imaging the brains of mice bearing AD-like pathology were able to directly observe the clearance of amyloid deposits after the mice were treated using an immune approach **(Chart #3)**; similar techniques in humans may ultimately enable the in vivo evaluation of preventive or therapeutic interventions against AD. Investigators in a third study, the results of which will soon be published, have created a new mouse model that carries a "reporter gene" – a gene that signals the occurrence of a particular event – in the brain. The gene itself emits light in response to certain types of injury to brain cells, and with an ultrasensitive camera – similar to the ones used in astronomy to detect low levels of light from faraway stars – we can capture and quantify light generated within the mouse **(Chart #4)**. This technology will facilitate new approaches to the study of key processes in living mice, and to correlating gene expression with disease outcome. Because each mouse can be imaged repeatedly, disease progression and responses to therapeutic intervention can be assessed. Other emerging technologies hold great promise in developing therapeutic approaches to AD, for example by blocking plaque and tangle formation, by stimulating repair of brain tissue, or by delivery of time-released medication.

*Obesity*

Recent research findings have further demonstrated the significant link between chronic obesity and heart disease, adult-onset diabetes, and certain cancers. These conditions ultimately shorten lifespan and decrease quality of life. Prevention and early

treatment of obesity will undoubtedly contribute to improvements in longevity and functional ability.

In a recent NIH co-funded study, a novel technique known as RNA interference (RNAi), in which double-stranded RNA is inserted into a cell to inhibit the activity of one or more genes, was used to identify genes involved in the regulation of fat metabolism in roundworms. **(Chart #5)** Using this new approach, each of the 17,000 genes of the roundworm was inactivated or "turned off." Researchers found that the inhibition of 305 genes decreased body fat, whereas the inhibition of 112 genes increased fat storage. This finding could lead to the identification of new targets for treatment of obesity and its associated diseases.

*Closing Remarks*

At the turn of the last century, it would have been difficult to imagine the strides medical research has made on longevity. It is our hope that with our increasing knowledge in the field of aging that we can help individuals to not only live longer, but to maintain functional and productive lives. I would like to thank the Committee and Congress for your support of NIH and NIA and for holding today's hearing on this crucial issue, the future of human longevity.

# Longevity Genes Across Species

| Nematode | Human |
|---|---|
| catalase | catalase |
| age-1 | $PI_3$-kinase (glucose metabolism) |
| daf-2 | Insulin-like receptor (glucose metabolism) |
| daf-16 | HNF3 (transcription factor) |
| WRN | WRN (Werner Syndrome) |

Known effect on aging

Animals with a mutation in the *age-1* gene live longer than wild type

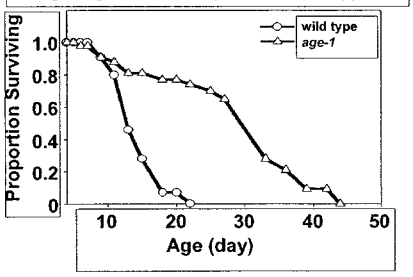



Chart 1

# Survival Probabilities of Centenarian Sibs

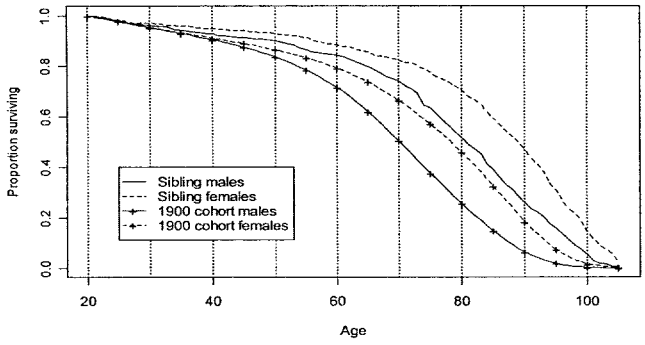



Chart 2

Perls TT et al. Proc Natl Acad Sci U S A 2002;99(12):8442-7

## *In vivo* imaging of β-amyloid deposits and clearance with antibody

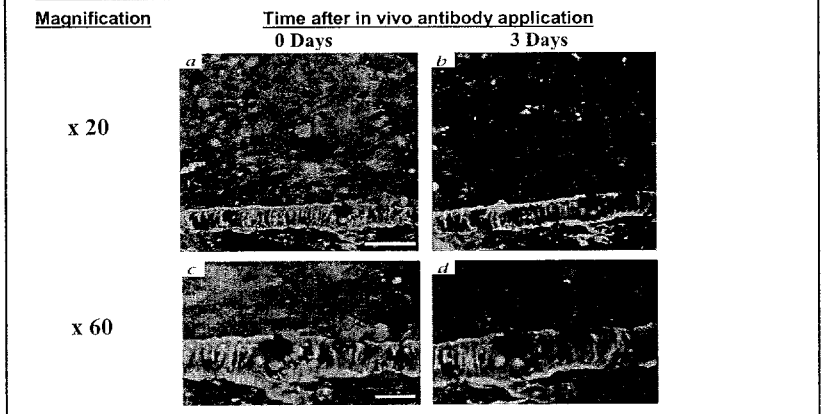



Chart 3

Bacskai et al, Nature Medicine, 7:369-372, 2001

## Imaging of Kainate-Induced Gene Activation in Live Mice

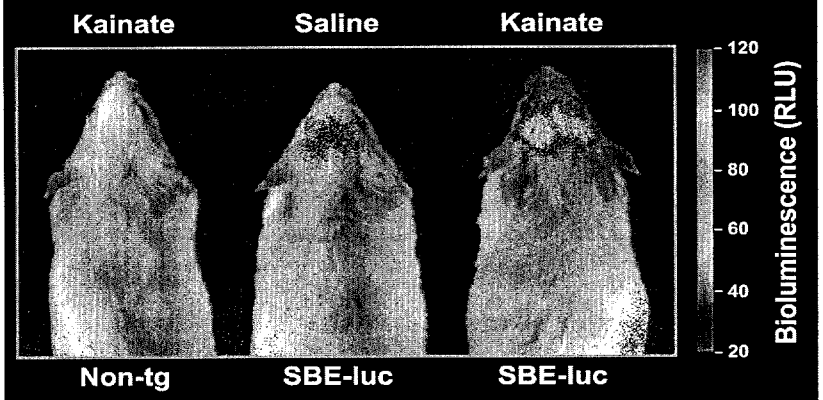
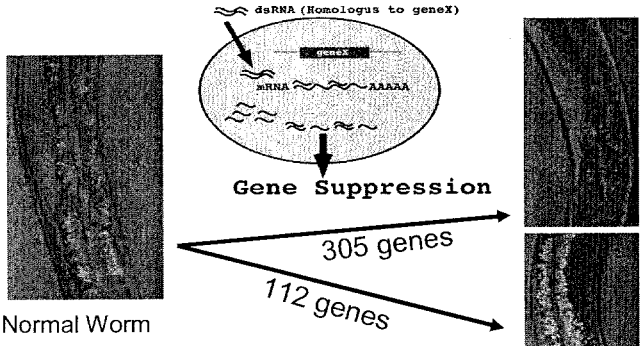



Chart 4

## New Discoveries in Obesity Research Using RNA interference (RNAi)






Normal Worm

305 genes

112 genes



Thin Worm

Obese Worm

Source: Ashrafi, K., Chang, F.Y., Watts, A.G., Kamath, R.S., Ahringer, J., and Ruvkun, G., "Genome-wide RNAi analysis of Caenorhabditis elegans fat regulatory genes," Nature, Vol. 421, pp. 268-272.

Chart 5

The CHAIRMAN. Thank you very much, Doctor. We appreciate your presentation on some of that new work that is going on. I think you filled the bill this morning.

Now let me turn to Dr. Peter Boettke, Director of Global Prosperity Initiative.

**STATEMENT OF PETER BOETTKE, Ph.D., DIRECTOR, MERCATUS CENTER GLOBAL PROSPERITY INITIATIVE, ARLINGTON, VA**

Dr. BOETTKE. Thank you, Mr. Chairman and members of the committee, for this opportunity to add my comments to the record on this very important public policy issue.

I have spent my entire career, I am an economist, and I have spent my entire career investigating the basic question of why some countries are rich while other countries are poor, particularly with respect to countries that are now referred to as transitioning economies or less developed economies.

The main points that I want to make on the relationship between economics and the question of longevity is the first one, which is reinforce a comment that has been made by both of our speakers, which is that modern man in Western democratic capitalist societies benefits from medical care, medicines, and medical technologies that enable them to live longer and more fruitful lives to such an extent that even kings and queens of a previous era would have been envious of.

Economic growth, GDP, is not an end in itself. We do not eat growth rates. We pursue economic growth because it enables people to live better lives. Economic growth is the greatest hope for the world's poor and measurements of economic freedom are positively correlated with economic growth. Economic growth is positively correlated with human longevity.

I have these graphs here which are plotting different countries that we have data for. In the graph on the left, we have countries ranked by their economic freedom, and we have their per capita GNP rates over here.

What we see is that countries that are defined as repressed are the ones that we find struggling in terms of economic survival. The ones that we rank as most free on this index of freedom, we are looking at things like monetary policy, security of property rights, tax rates, regulation, open international trade, basically a composite of about 10 different variables.

Then on the next graph on the right, what we are looking at is the per capita GDP rates and then the life expectancy that is experienced in those countries. We see in both of these examples, what we have is a relationship between—as we get more economic freedom we get higher rates of economic growth. As we have more per capita GNP, what we end up having is longer lives.

To put it simply, wealthier is healthier.

So the most important public policy issue that we face in addressing the problems of less developed economies, or the transition economies, or in our own country is to pursue public policies which allow markets to flourish and to generate economic wealth.

The contrast between the command and control approach versus the open society is most evident in the Soviet Union and in the less

developed countries. Just last week in the New York Times, Mary Feshback, a demographer from Georgetown University, reported findings about the difficulties that confront Russia.

The data provided shows that the Russian population will decline by 30 to 40 percent by the year 2050. For every 10 babies that are born in Russia, 17 Russians die. Death by tuberculosis in 2001, for example, were 29,000 compared to 781 in the United States. Heart disease deaths per 1,000 people in 2001 were recorded as 893, compared to 352 in the United States, more than twice as many.

Current life expectancy in Russia is 58 for men, 72 for women versus the life expectancy we experience in the United States.

On that issue, I should point out that between 1960 and 1985, the Soviet Union was actually the only industrialized country in the world to experience a decline in life expectancy. So it is not because of the recent transitions that life expectancy is going south. In Russia this is actually a longer-term trends that dates back to the Soviet era.

Markets, in contrast, give us the freedom and innovation that enables us to live longer lives. Human longevity, I would argue, is a function of four things. The increases in technological efficiency and economic organization that reduce the physical labor required for us to produce output.

Second, the increases in technological efficiency that improve the work and general environment in which we work and live.

Environment, the general environment, environmental quality is actually a luxury good. As our incomes go up, we actually consume more environmental quality. So one of the things that we want to do is make sure that incomes are going up.

Increases in medical knowledge, including treatments and medicine, and increases in medical technology, which include diagnostic techniques, surgical procedures, and equipment. Each of these four things are the result of the open society and its market economy. Markets give us the freedom to prosper.

In conclusion, I just want to emphasize the point that an open society is a necessary precondition for the sort of improvements in our economic environment and generates the medical innovations that enable us to live longer and more enjoyable lives.

I want to take this opportunity to thank the committee for holding these meetings on this very important topic. Thank you.

[The prepared statement of Mr. Boettke follows:]

MERCATUS CENTER
GEORGE MASON UNIVERSITY

# Command and Control versus Open-Ended Discovery: The Case of Human Longevity

**Statement Prepared for the Senate Special Committee on Aging**
***The Future of Longevity: How Vital are Markets and Innovation?***
June 3, 2003

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Mercatus Center at George Mason University
&
Professor of Economics
George Mason University

## I. Introduction

Thank you Mr. Chairman and Senator Breaux for the opportunity to add my comments to the record. I am Peter Boettke, Director of the Global Prosperity Initiative at the Mercatus Center and Professor of Economics at George Mason University. I have spent my career investigating the basic question: "Why are some countries rich, while others are poor" particularly with respect to those countries that are now referred to as Transitioning and Less Developed. The following views are my own, and should not be attributed to George Mason University, or the Mercatus Center.

Modern man benefits from medical care that was denied even the wealthiest man in society a mere 100 years ago. Today the average male or female born in a Western democracy can be expected to live well into their 70s, while the Kings and Queens of the past were born into a situation where the average life expectancy was half that. Infant mortality has declined drastically even in the past half-century in countries such as the UK

and US. This presents us with a dilemma, as Roy Porter points out in his *The Greatest Benefit to Mankind: A Medical History of Humanity* (1997, 715): "Never has it achieved so much or attracted such suspicion. The breakthroughs of the last fifty years have saved more lives than those of any epoch since medicine began." Yet at the same time, the longer we live the more likely we will fall ill and be in need of medicine. "Longer life means more time to be ill, and medicine is more open to criticism." (ibid, 716) Our demand for medical miracles increases as our life is expanded by miraculous medical discoveries. "The irony is that the healthier western society becomes, the more medicine it craves." (ibid, 717)

In spite of this irony, there can be no denying that citizens of the western democracies have experienced a tremendous increase in their health and well-being over the last century. This is not true for their counterparts in less developed countries and transition economies. Life expectancy, infant mortality, nutritional intake, and sanitation are positively correlated with economic freedom, and negatively correlated with government control over economic decision-making.

**Innovation**

The reason for this is straightforward. Market oriented societies are by necessity societies which encourage open-ended discoveries in science and technology. The price system, and its profit and loss barometer, guide decentralized economic actors toward the efficient use of resources and spur innovation. Today's inefficiencies are tomorrow's profit opportunities for whoever can discover the best way to address the problem. Economic actors within a market society are continuously experimenting on how best to produce products that satisfy the consumer demands of others. Many, perhaps most, of these experiments end in failure, but for those who succeed financial rewards are to be had. Every

act of entrepreneurship is essentially a wishful conjecture. The profit and loss system ensures that these wishful conjectures are both rewarded and disciplined. We get, as a result, a process of open-ended discovery of new and better ways to realize the gains from exchange, while ensuring that resources used in failed experiments will be reallocated toward more productive endeavors.

Command and control societies, on the other hand, attempt to eradicate inefficiencies and social ills through conscious design. Decision-making is centralized, and economic experimentation is truncated. As a result, innovation is restricted, and the gains from exchange are not fully realized. Ultimately, the main difference between command and control versus open-ended discovery is that the market economy generates wealth creation, while the command and control of government does not.[1] And this generation of wealth, or lack of, has profound consequences on the way in which individuals are able to live full and flourishing lives. Even a small increase in economic freedom leads to real gains and the slightest retreat has tangible consequences.

**Longevity**

Human longevity I contend is a function of four factors: (1) increases in economic productivity which has lowered the human physical effort required to produce output, (2) increases in technological and productive efficiency which conserves resources and reduces the environmental damage associated with economic activity, (3) increases in medical knowledge (including detection of disease and treatment), and (4) innovations in medical technology (procedures and equipment). These factors are interrelated and find their

[1] For a documentary history of the debate between socialism and capitalism see Boettke, ed., *Socialism and the Market Economy: The Socialist Calculation Debate Revisited*, 9 volumes (2000).

common cause in the open society of competitive markets. It is generally appreciated that a free market society generates sustained economic growth more consistently than alternative systems. It is less appreciated that this economic growth is a main cause of our increasing longevity due to reductions in arduous labor, improvements in the environments in which we live, and the creation of the material means to pursue remote ends such as medical research. It is my thesis that the command and control approach to economic policy has not replicated the experience of more open societies, in terms of material progress and medical innovation. As a result, the Lesser Developed and Transition Economies are not only capital starved, but nutritionally impoverished, disease riddled, and subject to harmful and unhealthy environmental conditions.

## II. The Quintessential Command and Control Approach – the Soviet Union

The costs to humanity of the communist experiment in the Soviet Union are unfortunately not always appreciated. We know of the tyranny of Stalinism, though perhaps fewer people know the magnitude of Stalin's crimes against humanity than should be the case. Moreover, it is important to recognize that the crimes against humanity began with Lenin and continued through to Gorbachev. Stalin was not a detour. The fundamental problems of communism in theory and practice were not in the poor selection of leaders, but in the economic irrationality of the Soviet system. The economic irrationality of the Soviet system meant that economic rationales for resource use gave way to political rationales – and with that the problems associated with concentrating power in the hands of a few.

The Soviet Union suffered significant losses of human life due to conscious decisions by leaders during War Communism (1918-1921), Collectivization and the Great Purges (1930s), and World War II (1940-45) to sacrifice these individuals for the good of the

revolution or 'Mother Russia'. But the costs in terms of human lives lost under communist rule in the Soviet Union was not limited to these policies of exterminations, however horrific they were. The environmental degradation that resulted from the forced industrialization dictated by central planning created unhealthy conditions for work and for living. Water was contaminated, the land destroyed, and the air polluted in the name of industrialization. The costs in terms of health of Soviet citizens is thoroughly documented in Murray Feshbach and Alfred Friendly's *Ecocide in the USSR* (1992).

The former Soviet Union simply failed to provide for its citizens. Decent medical care or housing, or even the basic nutritional necessities of life, could not be had by the average Soviet citizen through official channels. Data on health and human services document this point in gruesome detail. From 1964 to the mid-1980s, life expectancy had fallen from 67 to 62 for men and from 76 to 73 for women (see Boettke 1993, 36; Eberstadt 1988). The death rate of children in their first year of life was 22.9 per thousand in 1971, but the Soviet Union alone among industrialized nations, saw that rate rise to 25.4 in 1987, and probably a more accurate rate of 33 per thousand in 1989.[2]

If we look at the plight of LDCs, the picture is also grim indeed. As William Easterly points out in his *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics* (2001), the "infant mortality rate in the richest fifth countries is 4 out of every 1,000 births; in the poorest fifth of countries, it is 200 out of every 1,000 births." (Easterly 2001, 8). In low-income countries disease is both more prevalent and more dangerous due to less medical knowledge, poor nutrition and less access to medical care. Easily preventable

[2] As Feshbach a nd Friendly point out, traditional Soviet practice, contrary to international standards, counted premature and underweight babies as miscarriages rather than live births. Record keepers often falsified data to report death after first birthdays instead of before. Moreover, deaths in the first year have been underreported by an estimated 86 percent in part of Central Asia, and up to 50 percent in the Russian Republic. Given the prevalence of underreporting of the infant mortality rate, Feshbach and Friendly conclude that it is perhaps a conservative estimate to scale infant mortality upward by 50 percent. Thus, the official rate in 1989 being 22 deaths per thousand live births to 33 deaths per thousand. Feshback and Friendly (1992, 5).

and/or treatable diseases such as tuberculosis, syphilis, diarrhea, polio, measles, meningitis, river blindness and intestinal worms go untreated. It is estimated that two million children die every year from dehydration caused by diarrhea, and three million from bacterial pneumonia. Somewhere between 170 million to 400 million children are infected every year with intestinal parasites. The tragedy in all of this is that the medicines needed to alleviate these diseases are often extremely inexpensive – as low as ten cents a dose to alleviate dehydration and vaccinations against many diseases would cost about fifteen dollars per child. This fact simply highlights the wretched poverty of LDCs.

The answer, however, is not command and control attempts at development. As Easterly's book documents, all the attempts at development planning in the 20th century have failed. Instead, the greatest hope for the world's poor is integration into the world market economy. The quest is not for higher per capita GDP for its own sake, but for less dying babies, starving children, and oppression of the disenfranchised.

## III. Open Society and Economic Growth

Open societies do not suffer the plight of the Less Developed Countries or the Transition Economies. Utopia is not an option in the real world, and thus Western democracies have their problems. But as compared to the less developed regions of the world our daily struggle for survival is minimal. The market economy has generated so much wealth that we are able to address questions of environmental damage, treat disease with medicine and prolong life with surgery and other medical technologies. The material means generated by a market society enable us, in other words, to pursue other ends as we so desire; not just live longer lives, but to make the most of our longer lives.

If we look at the various indexes of Economic Freedom that have developed over the past decade --- e.g., The Fraser Institute and the Heritage Foundation/Wall Street Journal Index of Economic Freedom – we find that economic growth is positively correlated with measures of economic freedom, that is, market orientation. Sustained economic growth is not mysterious – secure property rights, low levels of taxation and regulation, open trade, fiscal prudence and stable money provide the basic ingredients for an economic miracle. This is just a more developed statement of what Adam Smith wrote in his 1755 notebooks which eventually became *The Wealth of Nations*: "Little else is requisite to carry a state to the highest degree of opulence from the lowest barbarism, but peace, easy taxes, and a tolerable administration of justice; all the rest being brought about by the natural course of things. All governments which thwart this natural course, which force things into another channel, or which endeavor to arrest the progress of society at a particular point, are unnatural, and to support themselves are obliged to be oppressive and tyrannical." (Smith 1982, 322). In the context of the modern measure of economic freedom, move up on the score of Economic Freedom and your per capita growth rate rises and your society progresses, move down on this score by further restricting your economy and your wealth declines and social progress ceases.

In the context of our current discussion, this relates to providing the material pre-conditions that enable individuals to live long and flourishing lives. If we look at the data on economic freedom and economic growth, and then economic growth and various measures of human well-being we find a positive correlation. (see Boettke 2002, 266-284) Simply put -- wealthier is healthier.

## IV. Conclusion

I have argued that an open-society, with its market economy, is a pre-requisite for generating the incentives for economic actors to use resources efficiently and discover better uses of those resources through time. The market economy spurs entrepreneurs to improve technological efficiency, which as a by-product reduces the onerous nature of work, and improves environmental quality. In other words, technological innovations make it less costly to produce the same output as before in terms of both human effort and resource use. For example, in the US, atmospheric emissions per constant $1,000 of GDP have been declining by approximately 4.6% per year since before WW II - from 380 pounds per $1,000 of GDP in 1940 to 60 pounds in 1988. Emissions per capita during those years also declined, from 1.1 tons per person to 0.5 tons. Energy consumption declined per constant $1,000 of GDP, at the rate of 1% per year. The reasons for this, I would argue, are (a) Market competition, which rewards innovation and efficiency, and (b) Environmental quality is a luxury good and thus the demand for it goes up as economic development and wealth increases in a society.

We have seen that life expectancy is positively correlated with economic growth. The causal story that I have suggested is that we are living longer, more active and enjoyable lives because the open-ended discovery process of the market society enables us to (a) work less and in less onerous occupations, (b) improve the environment in which we work and live, (c) enjoy the benefits of improved medical knowledge, and (d) reap the benefits of advances in medical technology.[3] It is well recognized that the capitalist system ruthlessly promotes

[3] To contrast with the former Soviet Union again, as Feshbach and Friendly point out, "In a country where, as in the United States, cardiovascular disease is the leading cause of death, there were only 130 angiogram devices in operation in 1988, and only 60 of them were of recent manifacture. X-ray machines could only be found in half of all hospitals and polyclinics, and only 2 percent of such institutions had the machinery to do ultrasound diagnosis." (Feshbach and Friendly 1992, 6).

efficiency, and generates wealth. Unfortunately, the benefits in terms of human betterment that capitalism brings are underappreciated. The market economy, with the lure of pure profit, compels us to realize the mutual gains from exchange with one another. In terms of the health and human services, it is the competition to do well by doing good that leads to innovations in terms of early detection, treatments, drugs, procedures, and technology that plays a major role in our ability to live longer, more active, and ultimately more enjoyable lives.

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The CHAIRMAN. Dr. Boettke, thank you very much for your testimony and analysis of different countries. I think that is extremely illuminating.

I was just in Russia. I think that my life would be much shorter if I had to live there. The only thing enjoyable about it was the visiting of the Winter Palace. I must say that.

That is not a criticism of Russia. It is just the reality at never having been there before. It was a shock to me that I was not prepared for, as it relates to the country and how it was functioning and not functioning. Recognizing that the things we take for granted just were not there.

Having said that, Mr. Speaker, let me turn to you. As I ask this question, the rest of you may wish to respond to it because obviously, Dr. Hodes, your testimony certainly lends to what Speaker Gingrich has said in his opening statement, that breakthroughs of the next 20 years will equal the entire 20th century as it relates to health and health-related areas. Clearly some of the things you were talking about is on the cutting edge of that kind of innovation and technology.

Newt, I have known you as a Congressman, and a historian, and now you are an observer of technological development and trying to bring it into context with your books and your speaking. Why? Why are we on this phenomenal path of acceleration at this moment in our Nation's history?

I am obviously much more aware of it, probably because I am getting older, but also because I chair this committee and I tend to focus and read more. I found it interesting the other day, the attention of a small clip on the news and in the paper, a lady out in California died, the oldest living American, 113 years of age. She had worked until she was 97. She had lived independent until she was 102. She passed away at 113.

Obviously she has been assisted along the way, she probably had some good genes, too. But respond to that comment, if you would, about that phenomenal acceleration that is currently underway?

Hon. GINGRICH. I think there are a couple of factors. First of all, I think the Congress and the political system deserve some of the credit. We came out of the Second World War having discovered, with Vanover Bush's leadership, how dramatically science could impact national security. We created institutions like the National Science Foundation, the National Institutes of Health. As you will remember, even in trying to balance the budget and work on spending in the late 1990's, we committed to doubling the size of the National Institute of Health budget.

I would point out that the Hart-Rudman Commission, which I helped create with President Clinton and then served on after I stepped down, issued its first warning when it came out in March 2001, arguing that the greatest threat to the U.S. was a weapon of mass destruction going off in an American city probably by terrorists, and that there was a need for a homeland security agency. After September 11, that got a great deal more attention than it got before September 11.

But the second warning we made was that the failure to continue investing in science and math, and the failure of science and math education was the second greatest threat to the U.S. after a weap-

on of mass destruction going off in a city. We said that it was, in fact, the failure of math and science education "is a larger threat to the United States than any conceivable conventional war in the next 25 years."

So I would say to you, on one hand, I am very optimistic about the scale of change. On the other hand, I am very worried about how much of that will be done by Americans in American labs as you project out over the next 20 years.

What has happened is basically a three-part process. First, massively bigger investment of resources. Without the scale of investing, and without the Advanced Research Projects Agency, you probably would not get the Internet for another 30 years. It is a Government-funded program and it was Government funding which led to the breakthroughs that created modern personal computing. The whole process of that investment in basic education, in graduate fellowships, in research grants, in research facilities is very important.

The second is that the rise of the Internet creates an ability to transmit knowledge in real-time, which becomes its own multiplier. Ideas that used to take 20 years or 30 years to be transmitted suddenly start to permeate the system almost overnight.

The third is that there is a cumulative breakthrough in knowledge, and I would say this one of the things that we tend to undervalue as non-scientists, and in instrumentation. It was impossible 25 years ago to look at an atom. There are now instruments that allow you to look at a single atom.

Now that breakthrough creates new capabilities. I say this because I think one of mistakes I participated in as speaker was too narrowly focusing our investment. I think we should have insisted on dramatically increasing the National Science Foundation at the same time we increased NIH.

I say that because it is math and physics which makes possible MRIs and CAT scans, and other important life-saving devices.

What you have today is more scientists and technicians working at much higher speeds through the Internet with very significant investments getting breakthroughs.

My last comment would be on nanoscale science and technology, where I participated with the NFS in several workshops. This is not a topic to take the committee off on in detail. But it is very hard to overstate how profound the transition is when you enter the area of nanoscale science and technology and you enter the zone of quantum mechanics.

The reason I was intrigued with what Dr. Stupp is doing is that you are beginning to get folks who approach all of this biological activity not as a function of genetics, but as a function of what actually happens at the atom and molecule level on the presumption that if you can re-create that, without regard to how it happens, the impact is stunning.

They are literally beginning to think you can regrow spinal cords by developing precisely what happens when the atoms and the molecules work together to create the original spinal cord.

This is so profoundly different than any approach we had 15 or 20 years ago. It would be a great surprise to me if we did not equal the 20th century in the next 20 or 22 years.

The CHAIRMAN. Either of you gentlemen wish to add to or make comment in relation to that?

Dr. HODES. I certainly would be happy to.

I would echo very strongly the very perceptive comments that have been made. While it is always a little uncomfortable for scientists to make specific predictions which are not research-based, I think if one simply takes the trajectory of scientific discovery as measured in almost any parameter conceivable, and projects from recent past to the future, it is hard to arrive at any expectation or prediction other than that which was just expressed, namely that we are on such an accelerated rate of increased discovery that the next decades are going to proceed at a pace that we have never seen before.

I would also agree very strongly with the general comments made about the contributions to this role. There is, above all, to be credited the genius of individual scientists. But scientists have always had that genius.

I think the way in which their contributions have been accelerated and multiplied is very much reflective of just what you have heard. When a single discovery is communicated almost instantaneously, and enhanced by the availability of technology and means of communication, this produces the exponential change in rate of discovery, communication, translation from one step to the next.

It is no longer the laboratory in an individual room by an investigator meticulously crafting a conclusion which he puts down on paper which weeks or months later is presented to a scientific meeting. It is now clearly instantaneous communication of technologically enhanced discovery that is responsible for this growth.

It is important, I think, as well to reinforce the significance of the support by Congress over these past years, most notably in this past 5 years with a doubling of the NIH budget.

A great deal of what I have reported as examples, as case studies, and the progress that has been made, has been enormously dependent upon the investment by the American people through Congress and the administration in these areas.

The CHAIRMAN. Well, the good news is while we recognize the value of that investment in the biological sciences and health, we are beginning to recognize that we are not making any equivalent investment in the physical sciences. I think that is beginning now to percolate upward here because we are seeing, as you have explained, Congressman, the clear commingling of those and the acceleration that happens when those sciences come together effectively. That work, or at least those considerations, are well underway now.

Let me turn to my colleague, Senator Stabenow.

Senator STABENOW. Thank you, Mr. Chairman. Thank you again to everyone.

I could not agree more that this is an exciting time in terms of technology and innovation, and that there is much to do in this area, and that it is a wise investment for the United States to be able to be focused in those areas.

Newt, you were talking about prevention. I think one of the important areas for us to refocus both Medicare, Medicaid, other in-

surance systems, is on prevention and the dollars that can be saved here.

But I am wondering, we are about to enter into a Medicare debate this month, about how we proceed under Medicare. Medicare is the one piece of universal health care we have in this country. We have made a commitment for older adults and for the disabled in our country. We also will be debating issues of costs in prescription drugs and how we bring down those costs using market factors in order to be able to lower prices for our businesses large and small and individuals, and so on.

I am wondering, Mr. Speaker, if you might speak—you were talking about market forces. I know, in reading just a little bit of the beginning of your book, you talk about the market forces and how we use that to bring down prices which will affect what we can do under Medicare prescription drug benefit, what we can do in the private sector.

I live in Michigan right next to Canada. We can look across the river and see another country where American-made drugs are offered at half the price that they are in our country. I wonder if you might speak to the notion of opening the border. We have free trade around the world. We have free trade certainly between Canada and Mexico and other countries.

I have legislation with colleagues that is specific to Canada that would open the border to free competition, understanding that their safety system in terms of FDA-type approvals are very, very similar to the United States, and the fact that those prescription drugs already come back and forth. It is just under the auspices of the companies right now, as opposed to individuals or pharmacists.

But how do you see market pressures in the global economy as it relates to pricing for prescription drugs which are such a big driver today in the whole question of cost as well as quality of care?

Hon. GINGRICH. You have asked an extremely important question. I appreciate you raising it this way. I think it really breaks into three components.

First of all, on the Canadian issue, I think as long as the regulations are the same, I personally do not see why NAFTA does not apply to Canada. I would draw a difference with Mexico where I think it is very hard to determine whether you are getting counterfeit drugs or inappropriate drugs.

But it does strike me as utterly irrational to expect somebody in Detroit, in a free society, to voluntarily only buy from their own drug store, knowing that if they go across that bridge they can get it at half price.

Now I would point out that in both France and Canada generics are much more expensive than they are in the U.S. but nonetheless I still agree with you, maybe to the horror of some of my former colleagues.

Senator STABENOW. I can quote you as supporting our bill when this comes up?

Hon. GINGRICH. As you know, the Congressman from Minnesota, Gil Gutknecht, has also had a similar bill on the House side. I said two years ago that I did not understand why we were punishing

Americans by artificially restricting them as long as the drugs are effective.

So first of all, I do think that you make a strong case.

There are two other considerations. The reason I proposed the Travelocity model is that I am really worried—and your state is taking a leading role in this—and by the way, I do not blame them for this about Medicaid. When you get to aggregated purchasing with governments, governments inevitably cheat. Why do the Canadians get such cheap prices? In part because they say to the drug companies, "we will steal your license if you do not sell it to us." Why do the French get such cheap prices? Because they say, "we will steal the license and give it away."

By the way, in France they actually spend more per capita on drugs than we do. But the American-made drugs are very cheap while the French-made generics are very expensive. It is pure nationalism masquerading as health policy.

In the long run, if every place in the world cheated the drug companies at the same rate that the French do, you would have very little new drugs coming in and it would be a very severe problem.

But the answer is not to artificially keep high drug prices. The answer, first of all, is to get to a genuine pricing mechanism that is real, where you know that of these 12 drugs, this is what their real price is and you choose. The sooner we can get to that, you will have exactly the same downward pressure on pricing you get from Travelocity and Expedia and the airlines industry. This is not a pro-big company position.

All the old airlines find it very hard to compete with Southwest and Southwest has made a profit for 29 consecutive years, because they are structured differently in their cost structure. I think you would have a similar period of difficulty.

The other comment I want to make is that, when you are thinking about health costs, it is true for the last couple of years that drug prices went up faster. However, last year hospital prices went up faster.

I think you will find very rapidly that trying to solve one piece at a time never quite works because costs just shift around in the system. That is why you want to go as much as you can and this is not about transferring money. Taking care of senior citizens is important, and we should do it. But getting the decision as close to the senior citizen as possible, and as far away from the public and private bureaucracies, actually leads to better decisions and ultimately to lower costs.

Senator STABENOW. I think it is an interesting comment, using the Travelocity approach. In Michigan one of the things that was done under a prior Governor was setting up formularies, essentially what prices—what kinds of drugs would be paid for under Medicaid and you would have to justify going beyond that, in terms of efforts of looking at costs, cost-effective drugs and so on.

Of course, this is something highly fought. In fact, our state was sued by the major companies, as a result of trying to get a handle on something like this.

So I think, assuming that—I would guess they might call this price-fixing or something like that, but I think you are absolutely correct that finding what is the lowest effective medication and

pricing that, and being willing to pay for that, and then people can have a different drug if they choose. If they want to go with the pretty pictures on television and go with something higher, they can. I think that that is an interesting approach to look at.

Hon. GINGRICH. Let me just comment very briefly. There are two distinctions. The first is, I believe in an open formulary. When you get into closed formularies, you end up with somebody other than you making a decision that eliminates your right to choose a drug. So this would be an open formulary that you would pay the difference.

The second is the co-payment model we got to is actually perversely reversed. If I go in and I know I have to pay $10, I actually have an incentive to buy the most expensive drug because psychologically I think I am getting a better return on my $10. So I am actually driven toward more expensive drugs because if it is an $80 drug, I get back $8 for every $1 I put in. Whereas, if I only get that $40 drug, I am only getting back $4.

If, on the other hand, you subsidize up front, then I get the least expensive drug for free, and I am taken care of. But if I want to then add out of my own pocket beyond that, it is a much clearer economic system than the way we historically, in the last 20 years, evolved into the current copay model.

Senator STABENOW. Just in closing, a comment. I would say for those who have insurance, at this point they are not probably looking at the price, I would say, in terms of what you are talking about. But for those who do not have insurance, most of whom are seniors and so on, they are clearly looking for the cheapest price that they can find at this point in time, given the choices that they have to make. I think the debate this month in the Senate will be very important as we decide how to strengthen Medicare.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you. Senator Carper.

Senator CARPER. Thanks very much. I just want to start off by asking, is it Mr. Boettke or Dr. Boettke?

Dr. BOETTKE. Dr. Boettke.

Senator CARPER. Is it Dr. Hodes?

Dr. HODES. Yes.

Senator CARPER. Mr. Gingrich?

Hon. GINGRICH. Yes.

Senator CARPER. All right.

Let me ask Dr. Boettke and Dr. Hodes to just respond to a couple of things that our former speaker has talked about. First of all, let us just take one of the issues that you raised, and that is the electronic prescribing of medication. Your reaction to what he is suggesting, good idea? Bad idea? Do you see any problems with it?

Dr. BOETTKE. No, I think actually that Travelocity model seems to be a pretty interesting one. I have not looked into it. I would like to look into it more.

I do think that the former speaker made extremely important comments about trade and pricing and also competition, and I think he also made very important comments——

Senator CARPER. Let me stop you, Dr. Boettke. I want to take a very narrow thing that he said, that he was talking about.

Speaker Gingrich, just take a minute and tell us again what you are talking about, the notion of prescribing medication electronically rather than by paper.

Hon. GINGRICH. There are two powerful reasons you want to have electronic prescription. The first is accuracy. Doctors' handwriting is often not as clear as it could be. Very small marginal changes can lead to people getting killed, which has happened last year in this city, a young lady was given 10 times the dose because they misread what the prescription should have said. So the first is an electronic prescription done on a Palm pilot or something else that is very accurate.

The second is that by being type electronic, it lends itself to measuring by an expert system to determine whether or not you are already taking a drug you should not be taking. Let me give you an example.

In Rhode Island a few years ago, 25 percent of all the emergency room visits by senior citizens was a result of being given the wrong medicine. So for both accuracy's sake in writing and for accuracy's sake in measuring it against your own medical record, I think electronic prescriptions will dramatically improve the system.

Finally, because 40 percent of all prescriptions currently require callbacks, you both save lives and save money because the pharmacist will not be calling you back and the doctor will not be wasting their time re-explaining what they have already done.

Senator CARPER. Dr. Hodes, your reaction to what he is suggesting?

Dr. HODES. I think these are extremely good points and importantly they are based not only on intuition, which would support them, too, but on a good deal of testable hypothesis. This actually is an important area of ongoing research, as well.

In particularly with older individuals who, even under the best management, are likely to have, as has been noted, a number of comorbidities and face the challenge of needing medications for multiple conditions, it is a real challenge even to the most sophisticated of physicians and pharmacists to track appropriately the multiple potential interactions. The data base that is the underpinning to an electronic prescription system really allows one to address this.

One can go still further, I think, on the same theme and talk about measurement of compliance and the importance especially with older individuals with very complicated drug regimens. That can be used by providing electronic feedback not only for the prescription writing, but as well for the monitoring of prescription compliance, as well.

So these are important areas, important recommendations, and important areas of ongoing research to extend still further the possible application of information technology to the application of optimal therapies.

Senator CARPER. Is there any role for the Congress with respect to this notion that Speaker Gingrich is suggesting? Is there something we ought to be doing or ought not to be doing?

Hon. GINGRICH. Here I am a Theodore Roosevelt Republican. I believe the Federal Government has an absolute obligation to mandate safety in health standards. I like the idea that if I go to

McDonald's, I know that the water is drinkable and the beef is actually beef. I want the delivery system to be free market, but I want the rules of the game within which the delivery system competes to be established by the Government, which was the Theodore Roosevelt breakthrough with the Food and Drug Act, for example.

I believe that the Medicare bill absolutely should have a very powerful section on patient safety. I believe that from the Administration for Healthcare Research and Quality, from the National Institutes of Health, from the Institute of Medicine, from the Food and Drug Administration, you can pull together a set of recommendations.

I also believe that institutions like AARP would be very supportive of establishing a higher standard for the country on computerized order entry of drugs which will save a substantial number of lives, on electronic prescriptions, on a number of other steps that could be done. So that you could require, for example, that within three to five years every hospital in the country would either have an intensive onsite or an electronic intensive care unit. There is no question this saves lives.

These are things that are not going to happen for a practical reason inside the current system. No hospital administrator can take on their doctors when their doctors are the primary source of the patients for their hospital. The system is just gridlocked today.

In some cases, we ought to have Federal funding I would argue that the biological threat to this country is four times as great as the nuclear threat, and that we should have the equivalent of Eisenhower's interstate highway system as an investment in Internet technology for biological survival in a real threat.

In some places I would have the Federal Government involved. In rural areas, I would look at some things that need to be done differently. But on balance, this bill should not leave the House and Senate without a very strong patient safety component that includes these kind of breakthroughs.

By the way, the best people I talk to believe this bill will actually cost less than the current system if you do it right. It will not cost more. Whether you can get CBO to score that it is argument I am having with CBO. But if you look at the scale of the breakthroughs, with comorbidity management, with electronic prescriptions, with computer order entry, with an electronic health record, this should be a substantially less expensive system than it is today.

Senator CARPER. I was just wondering, Mr. Chairman, if we got a patient—and one of our witnesses talked about an elderly person—who may be seeing a variety of doctors, taking a multitude of prescription medicines or non-prescription medicines, whose job is it to oversee the entire regimen, the entire medical medication, if you will, that a person is taking? If you are seeing, again, a variety of physicians, taking a variety of medicine, whose job is it?

I think you said if you deal with—talking about comorbidities—if you deal with the person in the totality, who is the you?

Hon. GINGRICH. Lois Kwan, who is the head of a major subsidiary of United Health and one of the smartest health managers in the country, has testified and has worked with staffs on the Hill on comorbidity management, and absolutely believes—and she

helped develop the Evercare model I described earlier, which literally currently saves the Federal Government money—improves the quality of life for senior citizens, and is stunningly effective.

She absolutely believes you can build a system. In the end you want doctors and patients to be in charge, not bureaucrats. But you want to build systems that make that easy. You want to build incentives that make that easy.

I think there is a growing belief that you could have an intelligent comorbidity management system that would again be part of an electronic health record. Because if you do not have that, you cannot make it work at a practical level.

When my mother first went into long-term care, I was stunned to realize that she was taking, at one point, 17 different medications from three different doctors, none of whom looked at her total record. It was breathtaking.

But CMS today does not design the incentive system, does not design the payments, does not design the structure. I think there is some obligation of Government to think through how you design the structure to empower the doctor and the patient to have this kind of intelligent capability.

Senator CARPER. Mr. Chairman, I am reminded a little bit in this discussion with respect to comorbidity management of an earlier witness that we had before us on a similar subject, a closely related subject. I am reminded of some work that is being done within the Democratic Leadership Council on this issue, I think some very good work.

I look for issues and ways that we can work together to face our challenges, and God knows, we have got a huge one with respect to health care costs and health care cost containment and better outcomes.

I think that with issues like comorbidity management, electronic prescribing of drugs, electronic patient records, that is a field that is well worth mining.

We have not been able to get into issues of privacy concerns, and I have heard some of those raised. I cannot stay longer, but I just would note for the record that I am encouraged by the conversation we have had here, Mr. Chairman. Somewhere along the line we need to have a further discussion on privacy.

Thank you. Nice to see you. Nice to see you all.

The CHAIRMAN. Dr. Boettke, I have one last question to ask of you. I could ask many more, we are running out of time this morning.

But when we talk about longevity, we are not just concerned about making sure people live longer lives. In this country it is longer lives and a better life in that longer life.

You talked about the comparatives you have looked at and a market-driven system, or if you will, a free system, open free enterprise system that tends to do that. What are the conclusion you draw? Why is this happening where it is not happening elsewhere?

Dr. BOETTKE. Well, as our economic wealth increases, we end up by having a more array of choices in our life. We can live different types of life, each to our own in some sense. Our wealth enables us to engage in more leisure. If we look at how much leisure we can enjoy today versus how much leisure our ancestors, our grand-

parents or what not could enjoy, look at various different technological innovations that have been driven by markets, say for example even the invention of the electric light which enabled people now to enjoy a personal life at home, work hours and what not, how much time we have to spend in order to generate a house, even given the rise in housing prices, the real amount of work that we have to expend now in order to purchase a house versus what our grandparents did.

The market society has generated tremendous amounts of wealth which enable us to enjoy the fruits of a productive life.

So as we get older, we also want to have more fruitful lives, more meaningful lives that we can live out. The wealth that is generated by a market society actually provides that for us.

What I was going to say before was that I thought that a point that Mr. Gingrich raised before in his original comments about the Europeanization of America in certain public policy issues, that is when you go around the world you see problems with pensions, problems with health care, problems with unemployment. I would also add problems of environment in the transition economies and our developing economies. The very policies that a lot of these countries pursue are the things that do not allow them to fix those problems.

The last thing that we should engage in is trying to engage in the Europeanization of the American system which would, in fact, exacerbate our problems with our health care system and our unemployment problem.

So to conclude, I think that what we need to do is make sure that we follow smart public policies which free up individuals to bet on ideas, find the financing to bring those bets to life, and to allow our economy to grow. With that you will end up by having people be able to expend more of their money on leisure, on the environment, on living better lives as we extend our lives through these benefits of innovations.

The CHAIRMAN. We think that is probably a pretty good thought to end this panel on. So thank you gentlemen, all very much for your participation today. Newt, I will look forward to getting a copy of that book.

Hon. GINGRICH. This is yours.

The CHAIRMAN. There it is. OK. Hand delivered, that is even better.

Gentlemen, thank you.

Thank you all much. We would ask our second panel to come forward, please.

Newt, if we could get you to move to the back of the room, thank you, we will get our next two panelists up.

Gentlemen, thank you very much for being with us today. You can see, by the tone of our first panel, some of the energy and the excitement that is going on out there. Of course, our great concern that as we craft public policy in these areas that we do it right so that we do not stifle any of that which is moving in the market today, and at the same accomplishes something that our society can afford.

So with this second panel, Stephen Goss, Chief Actuary at the Social Security Administration. Stephen, we thank you for being

with us and Dr. James Vaupel. Dr. Vaupel is Director of the Max Planck Institute of Demography in Germany and a senior researcher with the Terry Stanford Institute of Public Policy at Duke University. Doctor, thank you very much.

Steve, we will turn to you first for your testimony. Thank you.

**STATEMENT OF STEPHEN C. GOSS, A.S.A., CHIEF ACTUARY, SOCIAL SECURITY ADMINISTRATION, BALTIMORE, MD**

Mr. GOSS. Thank you very much, Mr. Chairman. It is a pleasure to be with you today.

During the last century, human longevity has literally exploded, as much as the world has become industrialized. Productivity and income rose to unprecedented levels, permitting vast improvements in the standard of living. Innovation in agriculture permitted adequate nutrition for whole populations. Innovation in engineering resulted in sanitary and safe living and working conditions. Innovation in medicine has resulted in immunizations and antibiotics that can be provided through primary medical care to all within these populations.

In recent decades, Europe, North America, and Japan have experienced great increases in life expectancy at age 65, averaging nearly one year of increase per decade. Some countries have risen faster, most notably Japan, and some slower.

The United States has been about average in this group, as you can see on the first chart. The average increase in the United States over the last three decades has been a little bit less than one year per decade.

Each year the Social Security Trustees report to the Congress on the actuarial status of the Social Security Trust Funds. This assessment depends critically on assumptions about the future course of longevity in the United States, among other variables.

How good have these projections been in recent years? The second chart indicates that the period life expectancies projected as of 1983 and 1992 in these reports for the year 2000 were pretty accurate. If anything, projections in 1983 were little bit optimistic, slightly overstating the life expectancy for 2000, particularly for women. This is true both for life expectancy at birth and life expectancy at 65.

For the future, mortality at higher ages is what we pay most attention to. Three-fourths of all deaths now occur in the United States at ages 65 and above. Chart 3 shows that in 1900 less than one-fifth of all deaths were at age 65 and over. Advances in infant mortality and reduction in mortality rates at ages below 65 have been dramatic during the past century.

Rates of improvement in mortality for the total population, men and women combined, is shown in chart 6. In the interest of time, I will not talk much about charts 4 and 5 above, for men and women separately.

The average annual decline between 1900 and 2000 for the age group 65 and over of a little over seven-tenths of one percent is about twice as large as experienced during the most recent 18 years of this period in the United States.

Going forward, we believe that achieving mortality improvement for the aged at about the same rate as we averaged for the entirety

of the last century is reasonable. This will be no small assumption to achieve. Matching the accomplishments of the last century, including with the pure positive effects of improved sanitation, nutrition, medical accessibility for all will not be easy. AIDS, SARS, antibiotic resistant microbes, along with increasing obesity and declining levels of exercise in the United States remind us that mortality improvement will not be automatic. There are forces that operate in the opposite direction.

For ages under 65, there is some agreement that mortality declines will diminish, the rate of decline will diminish from the level of the last century. The 1999 technical panel appointed by the Social Security Advisory Board endorsed the trustees' pattern of relative rates of improvement by age group. Moreover, the rate of improvement has diminished for this age group, under 65, through the last century, with slower average rates for the last 50 years and for the last 18 year period.

Implications for the cost of social insurance, Social Security as well as Medicare are substantial Social Security benefits are indexed to reflect the average wage growth and price inflation and thus, are relatively insensitive to variation in these parameters. However, there are no automatic adjustments in the Social Security program for changes in demographic parameters.

The drop in the United States birth rate that started in the 1960's will increase the aged dependency ratio, shown in chart 7, between 2010 and 2030. Continued increase in this ratio after 2030 reflects the more subtle but steady effects of increasing longevity.

Increases in this ratio of aged population to working age population translate directly to increases in the number of Social Security beneficiaries per worker covered under the system, shown in chart 8, and the program costs expressed as a percentage of the taxable payroll, shown in chart 9.

Continued increases in human longevity will require change for the Social Security program. We have known this truth for many decades. It was even evident in the projections developed and presented in the 1983 Trustees' Report to Congress that was produced right after enactment of the last major Social Security reform legislation.

How quickly longevity will increase is a subject we will continue to debate and observe. The trustees' track record over the last 20 years has been pretty good. We believe that the current assumption of a return to the remarkable rate of longevity increase experienced during the 20th century as a whole for aged Americans provides a sound basis for assessing the actuarial status of the Social Security program.

Thank you again for the opportunity to come today and I look forward to your comments and questions.

[The prepared statement of Mr. Goss follows:]

# The Future of Human Longevity: How Important Are Markets and Innovation

**Hearing of the Senate Special Committee on Aging—June 3, 2003**

**Stephen C. Goss, Chief Actuary**
**Social Security Administration**

During the last century human longevity exploded as much of the world became industrialized. Productivity and income rose to unprecedented levels, permitting vast improvements in the standard of living. Innovation in agriculture permitted adequate nutrition for whole populations. Innovation in engineering resulted in sanitary and safe living and working conditions. And innovations in affluence and medicine resulted in immunizations and antibiotics that could be provided through primary medical care for all.

## Past and Future Improvement in Mortality

In recent decades, Europe, North America, and Japan have experienced great increases in life expectancy at age 65, averaging nearly a 1-year increase per decade. Some have risen faster, most notably Japan, and some slower. The United States has been about average for this group, as seen in the first chart.

The Social Security Trustees report to the Congress on the actuarial status of the Trust Funds. The long-range projections needed for this assessment depend critically on assumptions for the future course of longevity. How good have those projections been? The second chart shows that the period life expectancy projected in the 1983 and 1992 Annual Trustees Reports for the year 2000 were pretty accurate. If anything, the projections in 1983 were a little optimistic, slightly overestimating life expectancy for 2000, particularly for women.

For the future, mortality at higher ages, at age 65 and above, is what we pay most attention to. Mortality at younger ages has declined so much that now three fourths of all deaths occur at ages 65 and above. Chart 3 shows that in 1900 less than one fifth of all deaths were at 65 and over. Infant mortality and death at ages under 65 declined dramatically over the last century.

The average annual rate of decline in mortality for men at 65 and older was fairly consistent over the last century. Chart 4 shows an average annual decline of almost 0.6 percent for the last 100 years, and about 0.7 percent over both the last 50-year and 18-year periods. For the future, we project continued declines in male aged death rates at over 0.7 percent per year. This is no small assumption. Matching the accomplishments of the last century, with the pure positive effects of improved sanitation, nutrition, and medical accessibility for all will not be easy. AIDS, SARS, and antibiotic resistant microbes, along with increasing obesity and declining levels of exercise, remind us that mortality improvement will not be automatic. Gains from

replacement organs and genetic engineering will be expensive, and may be difficult to provide for the population as a whole.

For women, the last 18 years have been challenging, with no improvement in mortality for the age group 65 and over, as seen in chart 5. The trend toward an ever widening gap in life expectancy between men and women ended in 1982. Going forward, we now feel even more confident than in the past in projecting mortality improvement at about the same pace for men and women.

Mortality for the total population, men and women combined, is shown in chart 6. The average annual decline between 1900 and 2000 for the age group 65 and over, of a little over 0.7 percent, is about twice as large as experienced during the most recent 18 years of this period. Going forward, we believe that achieving mortality improvement for the aged at nearly the same rate as for the last century is a reasonable assumption, with a roughly equal likelihood of doing better or worse.

For ages under 65, there is some agreement that mortality declines will diminish from the level of the last century. The 1999 Technical Panel appointed by the Social Security Advisory Board endorsed the Trustees' pattern of improvement by age group. Moreover, the rate of improvement diminished through the last century, with slower average rates for the last 50-year and 18-year periods.

**Implications for the Cost of Social Insurance**

The benefit structure of Social Security is indexed to reflect average wage growth and price inflation, and is thus relatively insensitive to variation in these parameters. However, the program and its financing are not automatically adjusted to offset the effects of changes in demographic parameters like birth rates and mortality.

The apparently permanent drop in the total fertility rate for the United States that started in the 1960's is slowing the growth in the population. More importantly, it is changing the age structure of the population, increasing the "aged-dependency ratio", i.e., the ratio of population age 65 and over to that at ages 20 to 64. The rise in chart 7 between 2010 and 2030 shows this effect. Continued increases in the ratio after 2030 reflect the more subtle and increasing effects of increasing longevity.

Social Security is financed on a basically pay-as-you-go basis, largely from payroll taxes. Thus, the ratio of beneficiaries to current workers is a critical determinant of the cost of the program, per worker. Chart 8 shows a pattern almost identical to the aged dependency ratio.

Because Social Security average benefit levels essentially track the average earnings level of workers who pay the payroll-tax contributions, the pattern of cost rates (as a percentage of taxable payroll) are the same as the aged-dependency and worker-to-beneficiary ratios. Chart 9 displays this pattern.

Continued increases in human longevity will require change for the Social Security program. We have known that truth for decades, and it was even evident in the projections presented in the 1983 Trustees Report produced right after enactment of the last major Social Security reform legislation. How quickly longevity will increase is a subject we will continue to debate. The Trustees track record of the last 20 years has been good. If the further improvements now projected are realized or exceeded, we will need to choose as a nation from a range of options for putting Social Security back on firm financial footing

Thank you very much and I look forward to your comments and questions.

**Chart 1. Change in Life Expectancy at 65 per Decade -- For recent 30-Year periods -- United Nations Data**

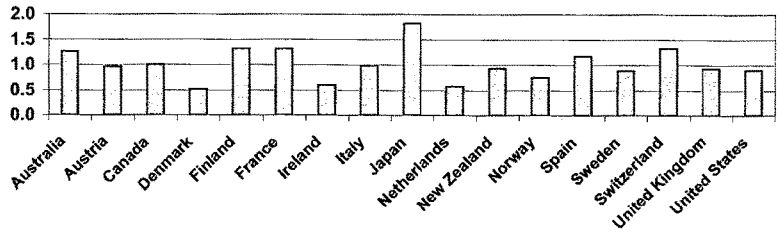



**Chart 2. Projected Period Life Expectancies for 2000 by Trustees Report**

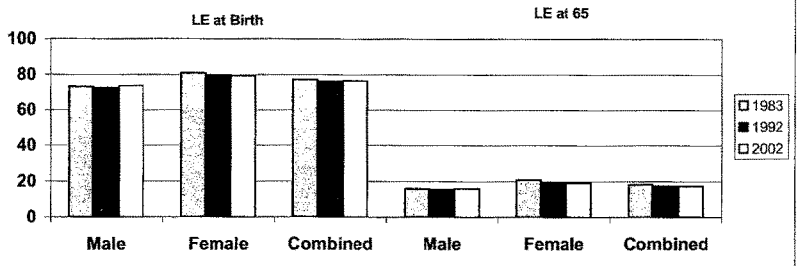
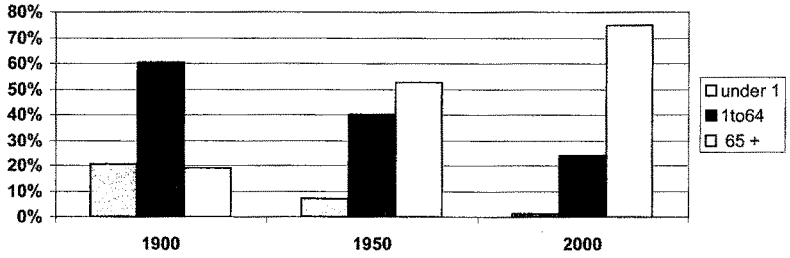



**Chart 3. Deaths in the United States by Age**



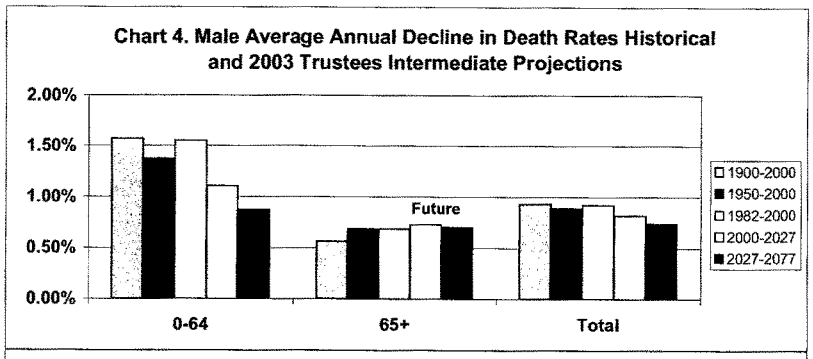


Chart 4. Male Average Annual Decline in Death Rates Historical and 2003 Trustees Intermediate Projections
2.00%
1.50%
1.00%
0.50%
0.00%
Future
0-64
65+
Total
1900-2000
1950-2000
1982-2000
2000-2027
2027-2077

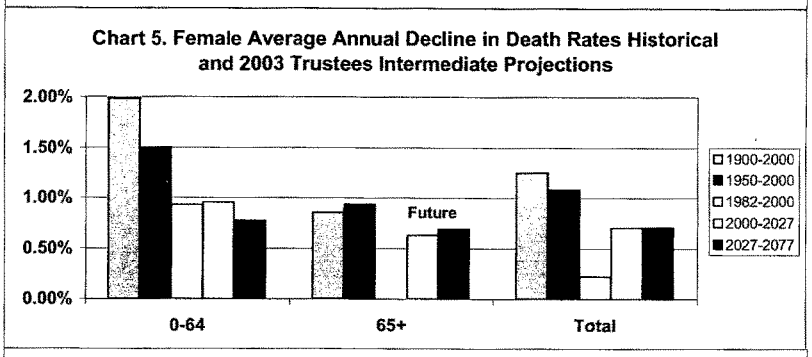


Chart 5. Female Average Annual Decline in Death Rates Historical and 2003 Trustees Intermediate Projections
2.00%
1.50%
1.00%
0.50%
0.00%
Future
0-64
65+
Total
1900-2000
1950-2000
1982-2000
2000-2027
2027-2077

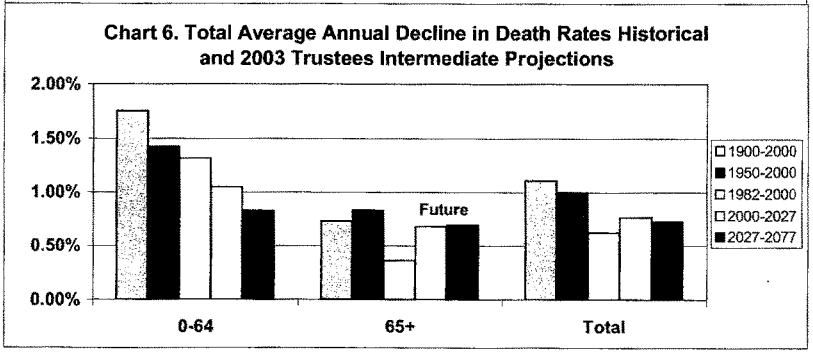


Chart 6. Total Average Annual Decline in Death Rates Historical and 2003 Trustees Intermediate Projections
2.00%
1.50%
1.00%
0.50%
0.00%
Future
0-64
65+
Total
1900-2000
1950-2000
1982-2000
2000-2027
2027-2077

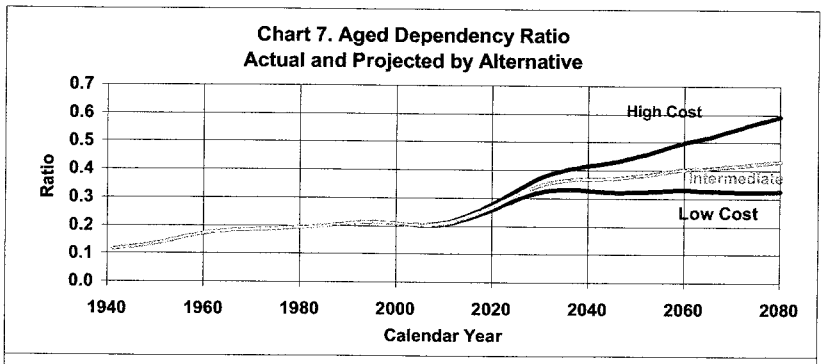


Chart 7. Aged Dependency Ratio
Actual and Projected by Alternative
Ratio
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
High Cost
Intermediate
Low Cost
1940
1960
1980
2000
2020
2040
2060
2080
Calendar Year

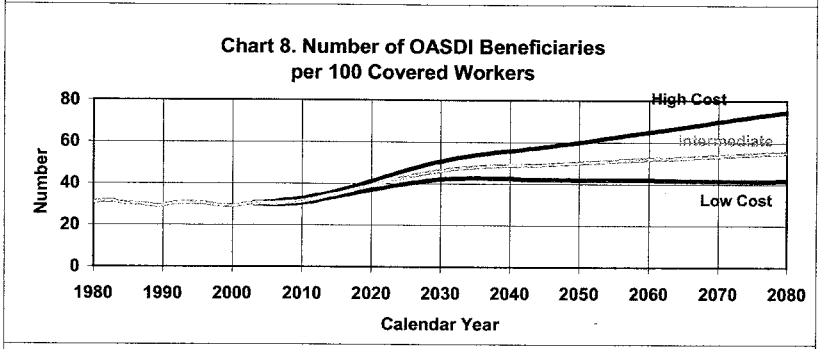


Chart 8. Number of OASDI Beneficiaries
per 100 Covered Workers
Number
80
60
40
20
0
High Cost
Intermediate
Low Cost
1980
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
Calendar Year

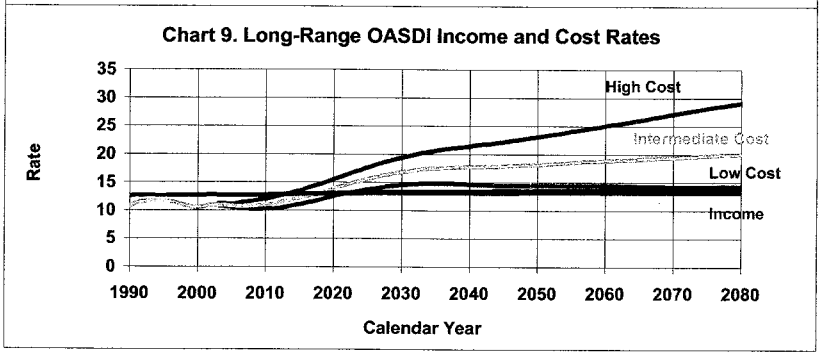


Chart 9. Long-Range OASDI Income and Cost Rates
Rate
35
30
25
20
15
10
5
0
High Cost
Intermediate Cost
Low Cost
Income
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
Calendar Year

The CHAIRMAN. Steve, thank you. It is Goss, is that correct?
Mr. GOSS. That is correct.
The CHAIRMAN. I apologize.
Doctor, welcome.

**STATEMENT OF JAMES VAUPEL, Ph.D., DIRECTOR, MAX PLANCK INSTITUTE FOR DEMOGRAPHIC RESEARCH, ROSTOCK, GERMANY**

Dr. VAUPEL. Mr. Chairman, is life expectancy approaching its limits? Many believe it is, but the evidence suggests otherwise.

Consider an astonishing fact: life expectancy in the record holding country has risen for 160 years at a steady pace of three months per year. In 1840 the record was held by Swedish women, who lived 45 years on average. Today, along nations, the longest expectation of life, just over 85 years, is enjoyed by Japanese women. There is no evidence of any slowing of this long-term rise in best practice life expectancy.

From 1900 to 1950, life expectancy increased rapidly in the United States, as Steve Goss mentioned. At mid-century, U.S. life expectancy was only a few months less than the highest life expectancy anywhere in the world. As recently as 1979, the U.S. disadvantage was only two years. Among people 80 years old and older, survival was better in the United States than anywhere else, a lead the United States held until 1992.

But health progress in the United States has slowed, especially over the past decade or two. Other countries have caught up and surpassed us. Today, U.S. life expectancy at birth almost is 6 years behind the record. In many countries, including Japan and France, people of all ages, from the very young to the very old, enjoy better survival chances than in the United States. The United States is the world's leader in so many things that it is surprising and disturbing that the U.S. has fallen so far behind in the matter of life itself.

The Social Security Administration forecasts that improvements in U.S. life expectancy will continue to be very slow. This implies that the life expectancy gap between the United States and Japan, between the United States and France, between the United States and almost all other advanced countries in the world will continue to widen by one or two months per year.

Consider the situation in 2050. A half-century may sound distant, but a majority of the people currently living in the United States will still be alive then. The Social Security Administration's latest forecast, the 2003 forecast, is that female life expectancy in the United States will gradually rise from 79.5 years today to 83.4 years in 2050. This level, half a century from today, is less than current female life expectancy in Japan and in France and in many other countries. It is 13 or 14 years less than likely Japanese and French female life expectancy in 2050.

The prediction for France and Japan and other countries is uncertain, but most of the uncertainty is on the upside. Breakthroughs in biomedical research could lead to even higher life expectancies, as the speakers on the previous panel emphasized. There is an enormous contrast between the optimism of the pre-

vious panel and the pessimism of the Social Security Administration.

Is it realistic to assume that the United States will fail to catch up in half a century with expectations of life already exceeded in Japan and France? Is it realistic to assume that the United States will fall more than a decade behind Japan and France?

Market economies around the world are tightly interconnected. Research ideas and innovations quickly spring across national boundaries by the Internet, as was discussed earlier. The United States will, I am confident, reduce the health disparities, implement the health care and health promoting innovations, and make the research investments needed to halt the widening life expectancy gap and then to reduce it.

A crucial first step is to figure out why the United States is falling further and further behind. There are guesses and there are assertions, but there are no persuasive findings. This is something that the Social Security Administration should be worrying about. This is something that the National Institute on Aging should be funding more research on. A larger concerted, and more focused effort is needed on why the United States is falling further and further behind other countries in life expectancy.

Many people believe that little or nothing can be done about health at older ages. This is nonsense. Mortality and many kinds of morbidity at older ages have declined remarkably over the past half-century.

East Germany, where I now live, offers a dramatic example of how much can be done to improve the health of the elderly. Under Communist rule, older East Germans suffered poor health and short lives. Today, a mere decade after the fall of communism, older East Germans enjoy the same high level of health and longevity as West Germans. In one decade. The number of centenarians over this decade has tripled. These people were around 90 years old when communism fell. But even at their advanced age, they were able to benefit from a Western economy and health care system.

In sum, given intelligent economic and social policy and continued investment in research, longevity and healthy longevity will increase in the coming decades. This is not a problem; it is a great achievement. But it will result in challenges for policymakers, especially concerning Social Security.

Thank you.

[The prepared statement of Mr. Vaupel follows:]

**Testimony before the Senate Special Committee on Aging,**
Hearing on "The Future of Human Longevity: How Important Are Markets and Innovation?"
10 a.m., June 3, 2003
by

*Prof. James W. Vaupel*
*Director, Max Planck Institute for Demographic Research, Rostock, Germany and*
*Senior Research Scientist, Terry Sanford Institute of Public Policy, Duke University*

Mr. Chairman and members of the Committee,

Is life expectancy approaching its limit? Many--including individuals planning their retirement and officials responsible for health and social policy--believe it is. The evidence suggests otherwise.

Consider an astonishing fact. Female life expectancy in the record-holding country has risen for 160 years at a steady pace of 3 months per year. In 1840 the record was held by Swedish women, who lived on average a little more than 45 years. Among nations today, the longest expectation of life--just over 85 years--is enjoyed by Japanese women. There is no evidence of any slowing of this long-term rise in best-practice life expectancy.

In the 19th century and the first half of the 20th century, the increase in life expectancy was driven by progress in reducing infant, childhood and early adult mortality. Since 1950 and especially since 1970 the continued rise in the expectation of life has been fueled by substantial declines in death rates at older ages. This progress has been accompanied by progress in extending the healthy, active period of life. The progress is due to the prosperity created by market economies and to innovation based on research.

From 1900 to 1950 life expectancy increased rapidly in the United States. At mid-century U.S. life expectancy was only a few months less than the highest life expectancy anywhere in the world. As recently as 1979 the U.S. disadvantage was only two years. Among people 80 years old or older, survival was better in the United States than anywhere else, a lead the U.S. held until 1992.

But health progress in the United States slowed in the second half of the 20th century and especially over the past decade or two. Other countries caught up and surpassed us. Today U.S. life expectancy at birth is more than six years behind the record. In many countries, including Japan and France, people of all ages, from the very young to the very old, enjoy better survival chances than in the United States. The United States is the world's leader in so many things that it is surprising and disturbing that the U.S. has fallen so far behind in the matter of life itself.

The Social Security Administration forecasts that improvements in U.S. life expectancy will continue to be slow. This implies that the life-expectancy gap between the United States and Japan, between the United States and France, between the United States and almost all other advanced countries in the world, will continue to widen by one or two months per year.

Consider the situation in 2050. A half-century may sound distant, but a majority of the people currently living in the United States, including nearly all children and young adults, will still be alive in 2050. The Social Security Administration's latest (2003) forecast is that

female life expectancy in the United States will gradually rise from 79.5 years today to 83.4 years in 2050. This level half a century from now is less than *current* female life expectancy in Japan and France and 13 or 14 years less than likely Japanese and French female life expectancy in 2050. The prediction for Japan and France is uncertain, but most of the uncertainty is on the up side--breakthroughs in biomedical research could lead to even higher life expectancies.

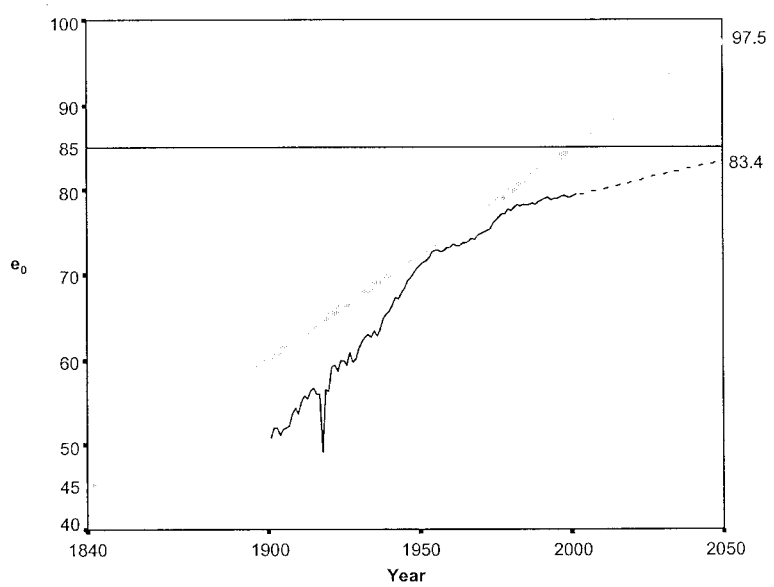



***FIGURE: Female life expectancy at birth ($e_0$) from 1840 to 2050.*** *The thick gray line shows the trend in female life expectancy in the national population with the highest life expectancy. The thin black line shows the trend in female life expectancy in the United States. The broken gray line extrapolates the long-term trend in best-practice life expectancy. The dashed black line shows the Social Security Administration's "intermediate" forecast.*

Is it realistic to assume that the United States will fail to catch up in half a century with expectations of life already exceeded in Japan and France? Is it realistic to assume that the United States will fall more than a decade behind Japan and France? I do not think so. Market economies around the world are tightly interconnected. Research ideas and innovations quickly spring across national boundaries. The United States will, I am confident, reduce the health disparities, implement the health-care and health-promoting innovations, and make the research investments needed to halt the widening life-expectancy gap--and then to reduce it.

A crucial first step is to figure out why the U.S. is falling behind. There are guesses and assertions but no persuasive findings. Research by demographers, epidemiologists and

economists could uncover the answers. The National Institute on Aging is funding some pertinent research; a larger, concerted, more focused effort is needed.

Many people believe that little or nothing can be done about health at older ages. This is nonsense. Mortality and many kinds of morbidity at older ages have declined remarkably over the past half-century.

East Germany offers a dramatic example of how much can be done to improve the health of the elderly. Under communist rule, older East Germans suffered poor health and short lives. Today, a mere decade after the fall of communism, older East Germans enjoy almost the same high level of health and longevity as West Germans. The number of centenarians in East Germany has tripled. These people were in their late 80s or early 90s when communism fell. Even at their advanced ages, they were able to benefit from a Western economy and health-care system.

In sum, given intelligent economic and social policy and continued investment in research, longevity and healthy longevity will dramatically increase in coming decades. This is not a problem--it is a great achievement--but it will result in challenges for policymakers, especially concerning Social Security.

The United States was once a longevity leader, especially at older ages, but the U.S. has fallen further and further behind, particularly over the past twenty years. The Social Security Administration assumes that the US's recent mediocre performance will persist. I doubt this. At the very least, the Social Security Administration should systematically assess the possibility that the United States will not fall further behind--and perhaps even catch up with--France, Japan and other advanced countries.

Because of markets and innovation, because of the research funded by the U.S. National Institute on Aging and other organizations, human longevity is going to rise substantially--not only elsewhere but for Americans as well.

Thank you.

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For other online publications, see http://www.demogr.mpg.de or the "supplemental data" and "search for similar articles" sites accessible at http://www.demogr.mpg.de/publications/files/brokenlimits.htm . In particular, excellent articles have been written in *Science*, *Nature*, and other journals by Ronald D. Lee, Shripad Tuljapurkar, John R. Wilmoth and colleagues.

The CHAIRMAN. Thank you, Doctor. Gentlemen, thank you.

What do I say? Maybe I say it this way, both of you have two substantially different points of view as it relates to projection of U.S. longevity. So at the risk of starting a gentlemanly argument, let me ask each of you to identify the limitations of your colleague's evaluations. Steve?

Mr. GOSS. Thank you, very much.

First of all, I would like to characterize the difference in our views as not being one of optimistic versus pessimistic, but of being optimistic and more optimistic.

The CHAIRMAN. That is another way of putting it, yes.

Mr. GOSS. A continuation of the rate of improvement in mortality at age 65 and over into the next century at rates that were experienced on average during the past century, is optimistic, and perhaps even bold. It is dramatic.

The CHAIRMAN. I am fairly optimistic about those rates, on behalf of myself. I do not want to move to Japan or change gender.

Mr. GOSS. But I think it is important to keep in mind the kinds of changes that occurred during the past century, the pure positive effects that they had.

The optimism that we had on the prior panel about some of the science and technological changes that we will have in the future is real. The question on those changes is the rapidity with which those will be realized, they will be developed, and they will be able to be brought to the population as a whole, and to the extent to which they will be pure positive effects on our population and its longevity versus effects that will have some good points and some bad points.

Improved nutrition, improved public safety, better drinking water, better sanitary conditions have no downsides. Many technological breakthroughs may have some downsides, and it may take us decades to bring them to the population as a whole.

But what I would like to do in answer to your question is address a couple of technical points about Jim's very, very creative and very insightful description of the chart included in his handout.

This idea of looking at the best nations' practice over about the last 150 years is very intriguing. However, there are a couple of technical points that are worthy of consideration. During a fairly substantial portion of this period, between 1880 and just short of 1940, the points on the curve which are shown in Jim's more expanded technical article were the result of data from one particular area of the world which, in fact, was not even really a complete national population. It was a portion of New Zealand, if I recall correctly. There is a very long period of almost 60 years in which maintaining this linear pattern is dependent upon the data from that area.

Some demographers we have talked to have suggested that if you did not have that portion of New Zealand supporting the linear trend during that fairly long period, and you had some lower numbers for some of the other countries, you would, in fact, uncover a trend that showed relatively slower improvement in best nation mortality in the latter portion of the last century and the early portion of this century. Then we would see the sudden explosion in the

rate of improvement in mortality during the first portion to the middle portion of this century.

It would also suggest that this curve, rather than being a line that might extend indefinitely, would be a line that had a more gradual slope for a while, then went up very rapidly in the middle portion of this century, and may be moving toward the shape of an s-curve with a little bit of a flattening toward the end of the last century.

I think this is a very possible scenario and many demographers believe that that may be really where we are headed.

The other technical aspect that I would suggest on this is a different possible interpretation, which I think has just as much chance of being valid. That is that there is differentiation amongst nations on the basis of lifestyle, diet, the nature of populations, in terms of the potential longevity that they might have, given access to what is currently available in medical technology and other technologies. I think this is fairly evident.

Right now the United States, many European countries, and Japan have reasonably well accessed most of what is available in terms of technologies, and yet we have quite a large difference in longevity. So there really are some differences that are not immutable, but some fairly strong differences amongst nations based on lifestyle and diet and other aspects of the population.

That being the case, when we look at this progression of best nation achievement of mortality, the sequencing through time of which nations have availed themselves of the current state of technology is really critical.

Japan, it might be argued—and people from Japan believe that this is perhaps the case because of the nature of their lifestyle, multigenerational families instead of people going to nursing homes, for example—believe that there are probably some inherent advantages that Japan has over some of the other countries listed in this progression. The fact that Japan, post-World War II, only in that timeframe began to avail itself of many of the technologies that other countries had availed themselves of earlier may explain why Japan has risen to the level it is at only recently.

The data we have seen suggest that in the last 10 or 20 years—and I think Jim would concur with this—there has been some deceleration in Japan, and likely there will be some more in the future.

So my suggestion is that we should be cautious in over interpreting this progression of a sequence of nations. This is not a single population or a single nation we are looking at, a trajectory, but really just a growth rate that has occurred by piecing together a number of nations which have very different characteristics.

The CHAIRMAN. Doctor?

Dr. VAUPEL. Let me respond to that.

First of all, let me say that I have the highest respect for Steve Goss, who is a really excellent actuary, but I disagree with him and I think some of his facts are incorrect.

First of all, matching the accomplishments of the last century is not what the previous panel talked about. The previous panel talked about the accomplishments of the last century being matched in 20 to 25 years. I think that is much more realistic.

Second, matching the accomplishments of the past century is not a very high aspiration when it comes to reducing death rates for elderly people. Mortality fell in the first part of the last century because of reduction in infant and child mortality. Only in the last part of the less century, in fact only in the last 30 years, have death rates started to fall rapidly for older people, in part because of the research that is being done on aging.

So matching the accomplishments of the last century in terms of older people is not a high aspiration. It is certainly not a high aspiration compared with the 20 to 25 years of the last panel.

Second, Steve is factually incorrect about the straight line that I show of life expectancy increase. In the Science Magazine article we point out, and have in the appendix, a diagram saying that if you look at the second best country you would have the same pattern. If you look at the third best country you would have the same pattern. If New Zealand never existed, you have the same pattern. In fact, if Japan never existed you would have a very similar pattern in recent years. This is not some outlier that is driving the whole curve. This is the rate of improvement in the countries that are doing best.

Third, we do not have to make any forecasts to be concerned. We can look at historical facts. The historical facts are the United States is falling behind. There is no arguing about that.

In 1979, the U.S. life expectancy——

The CHAIRMAN. Do you both agree on that point?

Dr. VAUPEL. Right, there is no argument. The United States is falling behind.

Mr. GOSS. That is true, but I would suggest that, the United States is not alone in that regard. It may be a question not so much of——

The CHAIRMAN. I will let you pursue that when he completes his thought.

Dr. VAUPEL. The United States is falling behind. We were two years behind the record in 1979. We were close to the record in 1950, two years behind in 1979. We are six years behind today.

This is not because—I mean, the life expectancy in the United States is partly due to mortality at younger ages. But our falling behind is largely due to the fact that we are making very little progress at older ages.

In fact, I will give you an amazing fact. Native-born white females, you do not ordinarily think of them as a disadvantaged group, but for native-born white females, there has been no improvement in mortality for this group in 20 years, at older ages. Life expectancy at age 80, for example, for this group is identical to what it was in 1982, 20 years ago.

So the United States is falling behind at older ages. The Social Security Administration assumes the United States is not going to catch up, the gap is going to continue. I do not see any logic behind that.

Mr. GOSS. I would like to suggest that one way of looking at this is the United States has been falling behind, and it certainly has. But another way of looking at this is that many other nations, for instance Japan, that may have certain advantages in terms of the lifestyle and diet, have simply been asserting themselves and mov-

ing ahead to positions in terms of life expectancy which perhaps are appropriate and should be expected. I do not think that we can expect homogeneity across all nations, in terms of life expectancy.

I could not agree more with Jim that the last 20 years have been very, very bad. In fact, shown right on our charts, which are not up there now but which you have in the handout, on our chart number 5, you will see exactly what Jim was talking about. Mortality improvement for females over the last 18 years has been zero. This is why we have, in fact, rejected the rate of improvement in mortality over the last 20 years and have looked at much longer periods, as has been suggested by a number of other demographers like Ron Lee.

Is it possible that we will, in fact, have much faster rates of improvement than suggested in the trustees' intermediate assumptions? Absolutely. We have alternative assumptions that incorporate this.

But I would suggest one other point, that the prior panel was talking about having, perhaps in the next 25 years, the possibility of technological and medical advances that would rival what we had for the entire past century. That certainly is possible. It is also possible that we will not have the ability to bring these breakthroughs fully to the whole population or to afford bringing them to the whole population.

The other point we have to keep very much in mind is that technological breakthroughs and medicine are not the whole story of the last century. Even if we do achieve the impact of medical technology breakthroughs that we had in the last century entirely in the next 25 years, there are so many other things like the improvement in nutrition and sanitary conditions that had major impacts in the last century, especially in the first half of the last century for the United States that would also need to be duplicated in order to even match the rate of improvement during the next century.

We are optimistic. Some are more optimistic, obviously. But I think the numbers that the trustees have, which have actually been increased fairly substantially in the last five years in their projections, are reasonable. I am not sure Jim would contend that.

I would also not contend with him that there is a very distinct possibility that improvement might be substantially faster.

The CHAIRMAN. Well, Dr. Vaupel suggests that officials responsible for health and social policies believe that life expectancy is approaching its limits. Do the folks over at the Social Security agree? Do the trustees, are they one of those institutions that agrees with that figure?

Mr. GOSS. Absolutely not and fortunately, Jim clarified that point for me when we were talking before the hearing started. I think he was referring perhaps to officials in some other countries.

As Jim is well aware, and a lot of people are in this room, the trustees have now for decades been projecting continued mortality improvement indefinitely into the future. We have never, ever assumed or projected that there is a limit to the maximum life expectancy that we would be approaching.

The CHAIRMAN. Did I misstate your comment in relation to that question? Would you like to clarify that?

Dr. VAUPEL. Steve Goss is absolutely correct, that many countries and many agencies that do forecasting, including the United Nations, assume some limit. But the Social Security Administration does not. The Social Security Administration assumes a very slow increase. No limit, but a slow increase.

The CHAIRMAN. You talk about the United States falling behind based on your observations. There has been some comment about why this gap might exist. Are there any other conclusions drawn as to what attributes to the gap?

Dr. VAUPEL. Mr. Chairman, as a demographer, I am very embarrassed to tell you that I do not know what is causing this gap. I am actually deeply grateful to have been invited by you to testify today, because it started me to think about this.

I previously had known about this but had not thought about it. I was afraid that you might ask me what is the cause of this increasing gap, so I tried to do some research to find out if anybody had done any persuasive fact-finding about this. There is really very little information.

The fact that I gave you before just astonished me, that native-born white females have made no progress in 20 years, despite the fact that we have a very good medical care system in this country, a very expensive medical care system, as you mentioned before because of Medicare and Medicaid and other Federal programs and State programs. There is universal access.

We should be doing very well. You might think of reasons why immigrants or males or minority groups might not be doing so well, but they are actually doing better than native-born white females. It is a real mystery.

The National Institute on Aging, the Social Security Administration, the community of demographers should really start worrying about this. What is going on? What is happening when the United States is doing so well on so many fronts but it is falling further and further behind on this critically important—you know, life itself, it is falling further and further behind.

The CHAIRMAN. Do you wish to make any comment on that?

Mr. GOSS. I agree with Jim completely, that we absolutely wish we knew more about this and had definitive answers. There have been suggestions of the possibility that female mortality has improved more slowly over the last 20 years, perhaps because women have increased the extent to which they are smoking, in absolute terms and relative to men, that women have been getting involved in behaviors in the workplace more to the extent that men have and perhaps have been exposing themselves to more risks and more stress.

The CHAIRMAN. I have read articles on that, and that argument is placed.

Mr. GOSS. There may be validity to that and there may not. We really do not have definitive answers as of yet.

The CHAIRMAN. Doctor, you made observation, living in East Germany, that East Germans had rapidly caught up with West Germans as it relates to longevity. This is a little outside where this committee is going, but I am curious because looking at the other panel and some of their work, and we look at market and marketplace and free market and wealth. You heard one of our first panel-

ists talk about those relationships. The Soviet Union, moving into a more market-oriented economy, and yet it has not improved the longevity of its citizenry.

I think the answer is obvious to me, but I would like to hear from you. Is it because the East Germans had the opportunity to immediately associate with the health care system from West Germany and incorporate that into a whole government, if you will, and a whole system and a whole health care delivery program? Whereas Russia has not?

Dr. VAUPEL. I think both factors have played a role. Following reunification, the West German health care system was extended to East Germany. Nursing homes were established. There had not been nursing homes before, there had been hospital wards for older people. This made a big difference. Modern medicine was available. A system whereby the government helped pay for medical care and medicine was implemented.

But in addition, the older people in East Germany started to receive West German pensions. Older people in East Germany started to be able to buy fresh fruits and vegetables.

The CHAIRMAN. So it was a matter of income.

Dr. VAUPEL. There was a higher income. There was a market economy that was established that let older people buy the things that they wanted and needed that made life better for them, that let them eat better, let them live better, let them heat their houses better, and so on.

So I think it is a mixture of both economic progress and a better medical system.

The CHAIRMAN. Thank you Gentlemen, thank you very much for your testimony this morning. I think it is extremely valuable for the record and for what we are attempting to build here in this committee for Congress to look at.

We do appreciate it. It is a fascinating topic that we better understand reasonably well, based on how we are trying to shape public policy and public programs at this moment. Failure to recognize it or misjudge it can be either expensive or certainly troublesome and a problem for our country.

We thank you very much and the committee will stand adjourned

[Whereupon, at 11:40 p.m., the committee was adjourned.]