



Technology for an  
Aging Population:  
Intel's Global  
Research Initiative



# How do people around the world experience aging?

What are the needs of the elderly, and how can technology address those needs? In 1999, Intel researchers began focusing on healthcare needs and how technology could address them. Three years later, Intel established the Proactive Health Lab that explored the ways in which technology can support the daily health and wellness needs of people in their homes and everyday lives. This research project continues to expand to this day. Its mission: to examine the social and cultural similarities and differences in people's experience of aging and health, and identify opportunities for new technologies to address the challenges posed by an aging global population.



The need to tackle the challenges is urgent. In 2002, 10 percent of the world's population was 60 years of age or older. By 2050, that percentage will more than double to 21 percent, or nearly two billion people.<sup>1</sup> As the elderly population increases, so will the incidence of chronic disease. In the United States, while 25% of the overall population has multiple chronic conditions, 67% of those over age 65 have two or more chronic illnesses.<sup>2</sup> These illnesses are costly. Today, on average, as much as half of all healthcare spending in developed countries goes to treat diseases and conditions of the elderly.<sup>3</sup>

Cost is not the only concern. As the elderly population is increasing, the pool of healthcare professionals is shrinking worldwide. By 2020, the United States alone is expected to face a shortage of more than one million nurses and as many as 200,000 doctors.<sup>4</sup> Most other countries are projected to experience similarly critical shortfalls in the coming decades.

At Intel, we believe that new technologies, designed with an explicit focus on the needs of older adults, as well as their



clinicians and family caregivers, can help to meet the challenges of an aging global population. Such technologies could ease the burden on strained healthcare systems while providing peace of mind and meaningful engagement for the aging population. Our research into the technology needs of the aging is focused on advancing personal health technologies, improving care in clinical environments, and promoting standards and policies that enable innovation and interoperability across the healthcare ecosystem.

<sup>1</sup> United Nations, "Population Aging 2002."

<sup>2</sup> Anderson G. Chronic Conditions: Making the Case for Ongoing Care. Baltimore, MD: Partnership for Solutions; Sept. 2004. Available at: [www.partnershipforsolutions.org/DMS/files/chronicbook2004.pdf](http://www.partnershipforsolutions.org/DMS/files/chronicbook2004.pdf) Accessed Feb. 13, 2007.

<sup>3</sup> Stephane Jacobzone and Howard Oxley, "Ageing and Health Care Costs," International Politics and Society, January 2002.

<sup>4</sup> Richard A. Cooper, M.D., "Weighing the Evidence for Expanding Physician Supply," Annals of Internal Medicine, November 2, 2004.

# A Global Research Approach

Using ethnographic fieldwork methods, the Intel Proactive Health Group initially explored the needs of older adults facing cognitive and physical decline in the United States. Ethnographic research involves living among the people they are studying, and spending a considerable amount of time with them to understand their ways of life, cultures and behaviors. Often times Intel's researchers would spend many days at a single household, listening to their stories and observing their daily activities. This research was conducted for more than two years in more than 40 households in four United States regions, and was supplemented with focus groups and in-depth interviews with family members and healthcare experts.

Today that work continues with Intel's health research team, an interdisciplinary group of social scientists, designers, and engineers. The team expanded its global aging research by traveling to seven European nations, applying ethnographic research techniques such as open-ended interviews, observations and multi-day visits at 80 homes of elders. Research participants have included people with a wide-range of physical and cognitive conditions, including those living with life-long or chronic disease. In addition, the team has interviewed a number of healthy older adults in each country, who served as a control group.

This research continues to expand beyond Europe and the US to Asia, Latin America, and Africa.

The Intel team of researchers have also met with many informal caregivers, and conducted dozens of interviews and consultations with experts from policy, academic, clinical and voluntary sectors in each market who could illuminate core issues facing aging populations and healthcare systems around the world. In addition, the team examined academic and policy literature relating to aging in each country, and commissioned research for several key markets.



**Since Intel began investigating health and healthcare in 1999, our ethnographic researchers have observed and interacted with more than 1000 households and 150 hospitals and clinics in 20 countries.**

# Common Themes

Intel's ethnographic research in the United States and Europe uncovered several commonalities in the attitudes and needs of the elderly across all regions. In general, the researchers found that people were receptive to the concept of healthcare technology, as long as it continues to provide them with a sense of control and empowerment. The elderly want to retain control over their lives and be involved in decision-making about their care. The research also reinforced the importance of caregivers in helping the elderly to maintain a high quality of life.

## Four main themes emerged across both regions:

1. The desire to stay engaged and have a sense of purpose
2. The need to stay connected socially
3. The importance of maintaining independence
4. Denial about aging and the challenges associated with it

### 1. The Need for Engagement and a Sense of Purpose

Across the United States and Europe, we found that older adults want to maintain the activities that make them feel engaged and grounded. These activities—from pursuing hobbies to participating in community activities—affirm their identity and may help their cognitive functioning.

Staying engaged and maintaining their regular routines are particular challenges for adults with cognitive impairment, which often threatens the activities that are most crucial to core identity. Intellectual and social pursuits are directly challenged, while physical and outdoor activities are often indirectly challenged because of the safety risks related to inattention and disorientation. Such challenges often require elders to give up the very activities that make them feel most engaged and grounded.

### 2. Staying Socially Connected

Healthy aging is inextricably linked to social participation. People of all ages aspire to have a sense of belonging, to continue to feel useful, productive, and engaged with family and community, without feeling they are a burden.



### Martha's Constant Struggle to Stay Connected

(United States) Martha<sup>8</sup> lives in an apartment building in the downtown district of a moderately sized urban area in the United States. She is 78 years old, lives alone, and is quite healthy except for occasional bouts of depression and fatigue. Her daughter, Nancy, lives across town, about a half-hour drive away. Nancy is married and has a daughter in college. Nancy and her husband run a small business out of their home, and struggle to keep their business going. They work long hours even on weekends to attract new customers and to provide quality service to their existing customer base. It's hard for Nancy to find the time to check in on her mother, drive her to the doctor, make sure she has enough to eat, and take care of the myriad issues and problems that come up. She tries to stop over whenever her work brings her into town, and tries to call every day to check in on Martha.

Martha tries to keep active. She walks every day, and belongs to a local book club. But she often gets lonely. "The weekends are the hardest," she says. "I don't know why I can't find a purpose (on) weekends. I wish they (the weekends) were gone." Martha feels that she should not bother her family on the weekends, because they have their own family activities to attend to. Nancy is surprised to hear this. She had always thought that Martha was doing fine on the weekends, and didn't want to be bothered. In subsequent weeks, Nancy tries to find the time to include Martha in weekend activities, but it is difficult with her schedule. Nancy wishes there were more ways to help Martha with her loneliness.

<sup>8</sup>The names and certain details have been changed to preserve confidentiality.

Social connectedness has been shown to ease dementia and to lessen the burden of cognitive decline for elders and their caregivers. And regardless of a person's mental condition, socializing is a strong motivation for participating in

other behaviors, especially exercise, that contributes to health and longevity. Our research, although not conducted for this purpose, supported the findings of other research on social isolation, indicating that socially isolated elders were less

satisfied with their lives, less optimistic, and generally in a poorer state of health than those with rich social networks.

Intel's research also pointed to a few differences between the United States and Europe that influence social connectedness. For example, the elderly in the United States tend to live in more urban areas, where as the elderly in Europe live in more remote locations. The research also revealed that the elderly in the United States were better connected via technology, such as broadband Internet connections, than those in Europe. Therefore, those in the United States were more likely to be socially connected through their communities and through technology than the elderly in Europe. However, the U.S. elderly was found to be less socially connected to their families because U.S. families are more geographically dispersed than those in Europe.

### 3. Maintaining Independence

To varying degrees, all of the older adults we met in the course of our research expressed concerns about losing control and independence. For some people, the physical home was a stand-in for independence; they felt that as long as they could live in their homes, they could tolerate other concessions of dependence

on others. Others felt that being part of a diverse community would help them develop the flexibility and strength that would be the basis for their independence. Still others framed independence in terms of not relying on anyone but a spouse for practical or financial help. In all cases, elders seemed wary of technologies that would lessen their perception of control.

Intel's research found that the social services support in Europe was much more comprehensive and available than social services offered in the United States, leading to the conclusion that the elderly in Europe were better equipped to maintain their independence based on this support.

### 4. Balancing Adaptive Denial and Realistic Awareness

Many older adults in our research study were in a state of adaptive denial about the negative impacts of aging. Adaptive denial is a positive coping mechanism acquired by the elderly or those with terminal illness. Research shows a definite link between optimism and good health. However, successful aging involves a balance between adaptive denial and realistic awareness of the possibility of cognitive impairment and other health problems related to aging. Denial often delays awareness of cognitive or physical

### Consequences of Aging Deprive Monica of Her Independence

(Spain) After her husband died, Monica<sup>9</sup> chose to live alone. Much of her retirement was spent volunteering at a national non-profit organization where she would organize trips and holidays for groups of seniors. Monica says, "everything was perfect until I hit 80, then everything started going wrong." A bad fall finally persuaded her to accept the offer of a room with her daughter, a hospital nurse and her houseful of teenagers. Though she likes her family, Monica is not happy with this turn of events as she feels a guest in the house, as if she is imposing. When the family gathers around the TV in the evening, she makes sure she goes to her bedroom so they have some privacy.

Loss of access to a good public transport system and a reliance on others for lifts has left Monica feeling isolated and dependent. Furthermore, she is aware of her old activities and identities being stripped away. "Now our relationship has changed – she treats me like a daughter now. Checks on things like what I am wearing when I go out or my personal cleanliness." What Monica's family hasn't told her is that she has been diagnosed with Alzheimer's disease. She was taken for tests after having to give up her volunteering work due to spells of disorientation and forgetfulness. She now spends much of her time at a day centre where she greatly enjoys doing crosswords, painting and is trying to put together a cookbook.

<sup>9</sup>The names and certain details have been changed to preserve confidentiality.

decline—awareness that might have led to early detection and treatment of illness. Instead, the elders' level of functioning is overestimated until a catastrophic event occurs—an increasingly frail parent falls in her home, or a dementia patient gets lost.

Most of the people in the research endorse the concepts of early detection and prevention of illness, but when it comes to their own health, the majority of participants were conflicted about proactively seeking detection. This balance between awareness and denial surfaced in almost every story.

On the one hand, people said that they wish they'd had more advance warning of a loved one's illness, so they could make better decisions, prevent health crises, prolong the elders' independence, and seek treatment while it could still have some benefit. On the other hand, they acknowledged having overlooked or trivialized many early signs that something was seriously wrong.

# Designing Technology for the Aging

The next phase of Intel's global aging research is to explore Asia, Africa and Latin America—regions with different cultural contexts and expectations about aging, and unique implications for technology development. While the research and learning continue, Intel has already begun to draw on the findings of ethnographic field work in the United States and Europe to design, prototype and pilot several new technologies for the aging. These technologies are based on known principles of design for those with disabilities, such as loss of visual, mobility, and control capabilities, which frequently plague the aging. Intel conducts ongoing testing with elders to ensure the technology is accommodating and useful.

Some of the technology Intel is exploring includes the following examples:

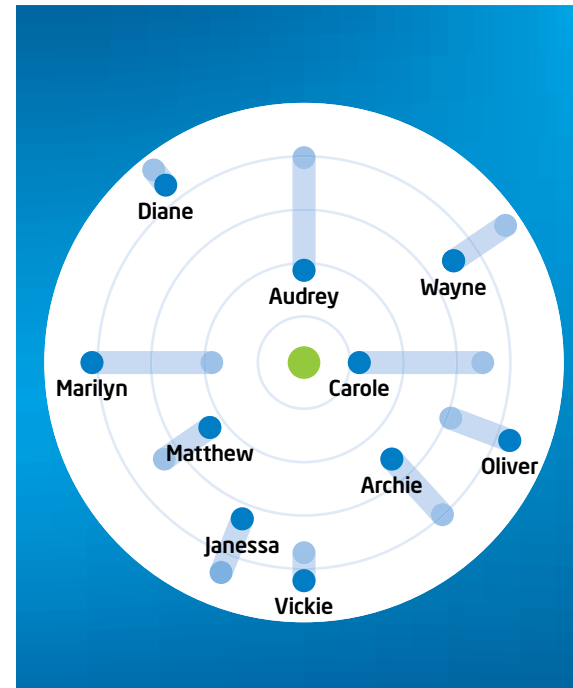
## Maintaining social health

Cognitive decline can result in increased social isolation and subsequent depression. Using sensor networks and online tools may mitigate some of these symptoms. Intel is piloting technology that uses in-home sensors to detect visits and phone calls, combined with online tools that summarize social activity. Researchers are exploring how this type of technology enables family members and patients to better support changing social lives, resulting in more social activity and cognitive engagement. It also could provide physicians with valuable

information to supplement office visits. More importantly, the technology could give useful feedback to the aging, encouraging them to reflect on their aging process and adjust their behavior in positive ways.

## Promoting meds compliance

For individuals with multiple chronic conditions, medication regimens can be daunting. Intel's ethnographic research confirmed that many older adults have problems in remembering to take their medications and supplements. In spite of this, few use reminder systems. Rather,



Intel is piloting technology that ultimately enhances the social connectedness of the elderly. The technology monitors and updates an elderly person's interactions (email, phone calls and in-home visits) with friends, family and others, and displays the results on a computer screen. The green "planet" in the center of the display represents the elderly person. The farther the center (elderly person) is from the other planets (family, friends, and others), the longer it has been since contact was made.

they arrange their home environment and the placement of medications to facilitate access and provide informal memory prompts. Neglecting to take medication leads to a decline in their health, which can result in hospitalization or the need to move to a care facility—and eventually diminishing their sense of independence that they so desire.

Intel is exploring a context-aware medication prompting system designed to help aging patients adhere to their medication regimens, and in the process,

help reduce the enormous costs associated with lack of adherence. Our research showed that a reminder device could help, but it would need to be pervasive, located in multiple places around the house (where the person's medications are distributed), and would need to be context- rather than time-based. The idea is to have an unobtrusive way to remind people to take their medications—only when they need to be reminded, when it is clear they have forgotten, so that the technology doesn't become intrusive and ultimately, discarded.

### Facilitating health research

SHIMMER (Sensing Health with Intelligence, Modularity, Mobility, and Experimental Reusability) is a project to develop a small sensing device that is suitable for long-term wear and can be used to capture physiological and behavioral data. The goal of SHIMMER is to facilitate research in independent-living technologies through a compact, extensible platform based on an open, flexible architecture.

In a sensor network, dozens, hundreds or even thousands of tiny, battery-powered computer devices, are scattered

throughout a physical environment. Silently and wirelessly, each device in this ad hoc network collects data. The device relays the collected data to its neighboring devices and then to a specified destination where it is processed. This sensory input, when gathered from all the locations and analyzed by more traditional computers, paints a comprehensive, high-resolution picture of the surroundings in real time. Intel researchers expect their work will enhance quality of life for elders, including the ability to “age in place” – to stay home rather than move to institutions.

### Beyond Research: Cultivating Collaboration

The complex problems being addressed by Intel's research group are beyond the capability of any one organization to solve. Since Intel began focusing on healthcare issues, we have been driving the development of a network of companies, government officials, universities and consumer groups to collaborate in finding solutions. Some of Intel's involvement and activities in healthcare include:

- Technology Research for Independent Living Centre (TRIL): [www.trilcentre.org](http://www.trilcentre.org)
- Center for Aging Services Technologies (CAST): [www.agingtech.org](http://www.agingtech.org)
- Everyday Technologies for Alzheimer Care (ETAC): [www.alz.org](http://www.alz.org)
- Oregon Health & Science University (OHSU): [www.ohsu.edu](http://www.ohsu.edu)
- Oregon Center for Aging and Technology (ORCATECH): [www.orcatech.org](http://www.orcatech.org)
- American Health Information Community (AHIC): [www.hhs.gov/healthit/community/background](http://www.hhs.gov/healthit/community/background)
- Continua Health Alliance: [www.continuaalliance.org](http://www.continuaalliance.org)

In addition to involvement to these groups and organizations, Intel has provided numerous grants to universities in the United States and Europe to focus on healthcare research since 1999. We also are helping to drive standards, to establish an eco-system of interoperable personal health solutions that empower people and organizations to better manage their health and wellness.



# The Next Generation of Healthcare

The ultimate goal of Intel's aging research is to understand the healthcare needs of individuals and their caregivers, and to invent the next generation of systems to support them. By helping people to become more proactive in managing their health, and providing caregivers (both formal and informal) with the tools and information they need to deliver care in any setting, from the home to the hospital, Intel hopes to play an important role in addressing the needs of the coming age wave.

We know that technology is not the panacea to solve the problems of an aging global population. However, Intel believes that it can be an integral part of the solution, and our United States and European research reinforces this view. We don't claim to have all the answers to the healthcare problems facing the planet, but we believe that we're asking the right question: How can we enhance the quality of life for a global population that will double in size by 2050, while reducing the cost of medical care through innovative technologies? We invite other businesses, governments, technologists and users to join us in finding the answer.

To learn more about Intel's health research efforts or to find specific research papers on the technologies mentioned in this piece, visit [www.intel.com/healthcare/research](http://www.intel.com/healthcare/research)

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