

the 1970s, including University of Chicago economist Gary Becker, believed that middle-aged parents' spending on adult children and on their own elderly parents is altruistic, motivated by the donor's perceptions of the recipient's need. As a result, reductions in public transfers to the elderly would be offset to some extent by increases in private transfers. In the eyes of some scholars, including economists Kathleen McGarry of the University of California, Los Angeles, and Robert Schoeni of the RAND Corp., the altruism model has not yet been ruled out. McGarry and Schoeni found that the less well-off an elderly parent, the more likely he or she was to receive a transfer from a middle-aged child. "To some degree," they write, "the middle generation acts like a government entitlement program by buffering elderly parents and adult children against economic hardship."

But other economists, including Boston University's Kotlikoff, have used survey data to test whether, as altruism-based models would predict, well-off family members share their wealth, helping to equalize household consumption throughout an extended family. They don't, Kotlikoff finds: Instead, each household's consumption depends mainly on its own income. "Without Social Security and Medicare, there would be some higher level of private transfers from young to old, but nothing near the magnitude of what we have the government forcing us to do," he says.

Beth Soldo, a demographer at Georgetown University, points out that the magnitude of transfers within families must be considered within a broad demographic context. The baby boomers have fewer children than previous generations to support them when they retire, for example, a trend that will be further exaggerated by the greater labor participation rate of their daughters, she notes: "Unless you model death and disability rates of the coming generation of retirees together with labor supply and other factors, you have an incomplete account of the benefits and burdens accruing to any one generation."

It will be years, Soldo and other researchers say, before demographers, economists, and policy-makers gain much confidence in their answers to all the thorny social and political questions raised by population aging. And in the end, as some of their work indicates, it may be better not to hope for too much longevity too soon. Consider the perspective of Elina Makropulos, who, at the end of Capek play, chooses death over another 300 years of life. "You cannot go on hoping, creating, gazing at things for 300 years," she admits to Kolenaty. "You fools, how happy you are! And it's simply due to the ridiculous coincidence that you're going to die soon."

—Wade Roush

## THE DEVELOPING WORLD

# New Populations of Old Add To Poor Nations' Burdens

When Alexandre Kalache, a native of Rio de Janeiro, was setting out for medical school in the late 1960s, he paid a visit to a local nursing home. It was a "spacious, clean, and pleasant" place that housed some 400 patients, he recalls. But a few years ago, when Kalache, who now heads the World Health Organization's (WHO's) Aging and Health Programme, went back to the home, it was shabby and depressing—with 1300 occupants. And they may be the lucky ones: Last month a public scandal erupted over filthy and vermin-infested conditions said to have caused up to 100 deaths in Brazilian nursing homes. This is the kind of thing that may become commonplace in developing countries with fast-growing older populations, where Kalache says, "Lack of policies will lead to disaster."

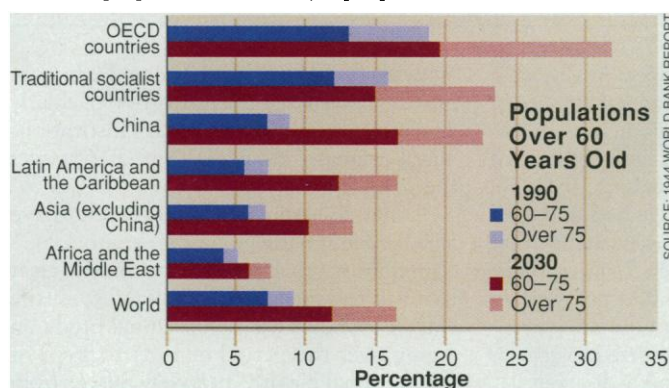
Indeed, while most discussions of the problems of aging populations focus on the industrial world (see pp. 42 and 44), a similar demographic transition is happening all over the developing world as well. And coming on top of all the other problems attendant on poverty and overpopulation, it threatens far more serious difficulties for developing countries. They now face massive increases in both the numbers and proportions of elderly—people who

nutrition and sanitation, have raised the average life expectancy in developing countries from about 40 in the early 1950s to almost 62 in 1990, according to the U.S. Bureau of the Census. As a result, says Census Bureau demographer Kevin Kinsella, 56% of the world's over-65-year-olds are now in those countries, and that proportion is growing: Each month, the world sees a net gain of 800,000 people over 65, 70% of whom are in the developing world.

And because fertility rates are declining in most countries, the growth of older populations is outpacing total population growth. Take China, where fertility has plummeted from 4.9 births per woman in 1970 to 1.8 this year—a trend that was already well under way when that country initiated its one-child-per-family policy in 1979. That drop, combined with a 30-year increase in life expectancy since 1950, means that between 1982 and 2000, the number of people over 60 in China is projected to increase by 72% while the total population grows by only 19%.

In countries already hard pressed to meet basic needs, it's far from clear where financial support for these burgeoning elderly populations will come from. In China, only about half of urban workers (about 10% of the country's working population) are covered by old-age pensions, says sociologist Jersey Liang of the University of Michigan. In rural areas, only government workers get pensions. In India, the situation is worse: Less than 8% of its population, mainly government workers and employees of large corporations, is covered by social security programs, says labor economist Kasturi Sen of Oxford University.

And that's not likely to improve. While Asia's "tigers," countries with booming economies such as Taiwan and South Korea, can afford formal social security systems, governments in poorer countries aren't likely to follow suit. They have more pressing concerns, such as creating additional jobs to keep up with the results of runaway population growth. Unemployment, on the rise since the 1960s, has now reached "crisis" proportions, says José Luis Bobadilla, an



**Phase transition.** Longer life, lowered fertility are dramatically transforming population profiles worldwide.

as a rule will have no old-age pensions, who no longer can count on help from their families, and who will have access only to the most rudimentary medical care. "This is a problem which has sort of exploded on peoples' radars in the last 5 years," says Omar Rahman, a physician at Harvard School of Public Health who does research on aging in Bangladesh.

Paradoxically, the problem is the result of a huge public-health success story: Antibiotics and vaccines, combined with improved



epidemiologist at the Inter-American Development Bank. So when it comes to responding to the growing numbers of elderly, policy-makers are still relying on traditional solutions. Says Kinsella: "You are always hearing the health minister or the interior minister say 'the family is going to be the savior of the elderly.'"

### Family breakdown

But traditional family structures are deteriorating. One reason: Lower fertility means there are simply fewer young people to take care of the old. Not long hence, observes sociologist Donald J. Adamchak of Kansas State University, it may not be uncommon to see "a married couple [in China] with four elderly parents to take of."

In addition, notes the World Bank, economic development and all that goes with it disrupts traditional social systems and "weakens [the] informal arrangements" that most of the people in the world rely on for their old age. Urbanization also widens the culture gap between old and young. In Taiwan, for example, says Liang, close to 60% of the population over 60—including 80% of the women—is illiterate, while the children are urban and educated. The erosion of traditional values and the dispersal of extended families may leave elders alienated and lonely, says WHO's Kalache, even when they live with their children. He cites a recent study in São Paulo, Brazil, showing that "older women living with their children and families are three times more likely to be clinically depressed than those living on their own."

Even worse off are elders who are left behind in the villages, as often happens in Africa. In Zambia, for example, says sociologist George Alter of Indiana University, young people are moving to the city to look for work, but unlike in the past, "old people are telling us ... that their children can't afford to send them money."

In sub-Saharan Africa, moreover, AIDS is disrupting traditional family structures and adding a tragic new dimension to the pressures on the elderly. The disease is mowing down large numbers of middle-aged people and leaving old people not only childless but saddled with the care of orphans left behind. "What we're seeing now over the last 7 or 8 years is the middle-aged dying or becoming incapacitated by HIV and a rapid increase in the number of orphans," says Adamchak. Kalache says the following scenario is not uncommon in Zimbabwe: "There's an old woman in a rural village. Her daughter in the city gets AIDS. She moves

back home to be looked after by her mother." The first thing the mother does is sell her meager valuables in order to pay the witch doctor to appease the gods. But the daughter dies, leaving the old woman, impoverished, with her grandchildren.

Even when old people are lucky enough to have children to lean on, the family may have few resources to devote to them because of worsening economic conditions in many countries. Indeed, in some areas, widespread unemployment is even reversing the dependency equation. That's especially true in South

tom of the list, at \$2. In comparison, the United States spends \$2763. One consequence, says Bobadilla, is that "most developing countries provide hospital services for only a fraction of the population."

And there could be a medical nightmare ahead as the population ages: Notes Richard Suzman of the U.S. National Institute on Aging, "Chronic disease morbidity and disability could explode in some countries given only modest changes in life expectancy." Bobadilla says that's already happening in Mexico, where, he and colleagues estimate, hospital admissions due to cancer and cardiopulmonary diseases will increase by about 40% between 1985 and 2000.

But even as developing nations experience a shift to diseases of the industrialized world—what demographers call the epidemiologic transition—in parts of their populations, they are also still plagued with the disease patterns of the developing world, says Bobadilla. Mexico is a case in point, where he says hospitals are still overwhelmed with the classical problems of underdevelopment such as diarrhea and respiratory problems in children.

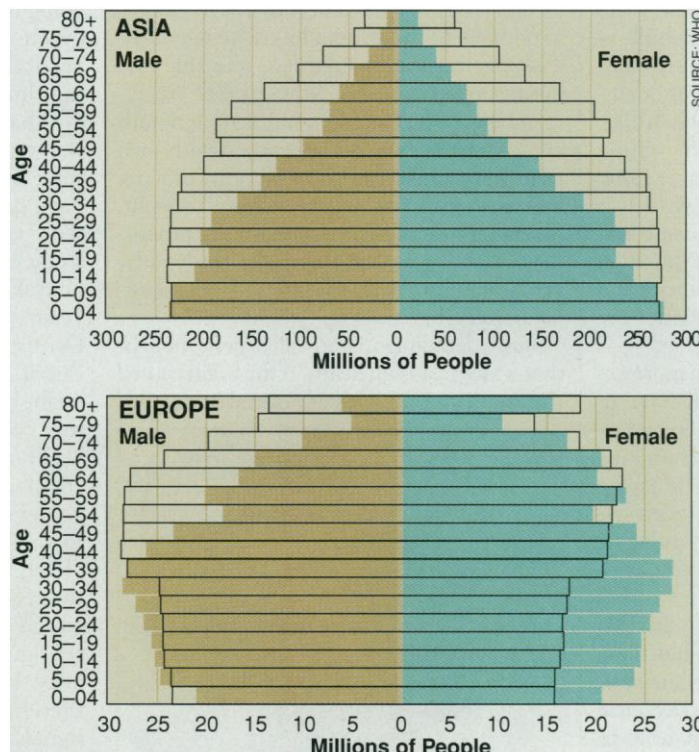
Given the lack of resources, the needs of the elderly are bound to trigger a "huge conflict between the health systems for infectious diseases and the health systems for chronic diseases," which will pit old against young and rich against poor, says Oxford's Sen. In her native India, for example, economic reforms and an accompanying surge of foreign investment have benefited the urban elite—who, in turn, put tremendous pressure on the government to supply

the high-tech health care appropriate for a wealthy, aging population. The consequence is exacerbation of an already yawning gap between the few elderly who are well off and the vast majority who have virtually no health care.

### Solutions for the future

How countries approach these problems depends on their economic status. Taiwan, with its strong economy, recently inaugurated a Canadian-style system of national health insurance. But most governments in the developing world are leery of such costly schemes. Says Harvard's Rahman: "We need to learn from the mistakes of the West and not duplicate the huge welfare sectors" that are draining budgets.

Instead, some of the wealthier countries in Asia and Latin America are looking at mandatory pension and savings plans and finan-



**From pyramid to pillar.** In China, and elsewhere in Asia, the age distribution of the population is starting to resemble that of developed countries. (The colored bars show the 1995 distributions and those projected for 2025 are outlined in black.)

Africa, one of only two sub-Saharan countries—the other being Namibia—that has a national old-age pension, which these days is often a family's main income source. "I know instances where there's a grandmother and 10 adults living on the grandmother's pension," says Priscilla Reddy, a public health worker at the Medical Research Council in Cape Town.

### Health care vacuum

With basic needs going unmet, health care looks like an impossible luxury for many of the world's aged. Already, health care systems are facing impossible demands in the developing world. According to World Bank figures, in 1990, average per capita spending—public and private—on health in middle-income countries such as those in Latin America was \$105. For poor countries the average was \$16, with Vietnam at the bot-



cial incentives for families to take care of their elders. One model is a system adopted by Chile in 1981, in which all wage earners are required to contribute 10% of their pay to one of a number of private pension funds that invest the money on their behalf. Singapore has both a compulsory savings plan for workers and tax breaks and preferred access to government housing for those who have older relatives living with them. Singapore and Hong Kong, like many developed nations, also have multitiered health systems that include hospices for the dying and visiting nurses for the elderly.

But in the countries where the bulk of the developing world's population resides, government social security programs or employer-subsidized pensions will be filling only a fraction of old peoples' needs. China has even taken a step backward, says Liang: "Before the economic reform, two-thirds of the population was covered by some sort of health insurance." But now "much of the collective and public infrastructure and services have deteriorated [and] are not being replaced."

In countries that can't afford the more expensive social services, people will have to rely instead on developing community systems that will supply both support and information on care for the elderly. Kalache says it will be crucial to promote low-tech and cost-effective interventions, such as inducing people to take an aspirin a day to lower the risk of heart attack.

In Jamaica, a pioneering step in this direction has been fostered by Denise Eldemire, a public health worker at the University of West Indies. Eldemire has designed a course to train community members on how to care for elders that covers subjects such as the aging process, basic hygiene, working with the family, and foot care for diabetics. One thing the students learn is how to build a walker. "There's no way we can fund a lot of programs, so we have to enable families and caregivers to provide care," says Eldemire.

Efforts like these are necessary, says Kalache, who has a pitiful annual budget of \$18,000 to try to wake up the world about its aging populations: "Ignoring aging as a development issue will erode the foundations for socioeconomic development." The young will be shortchanged, because "if you don't have policies for the aging, the very nature of the problems of old age will take over," he says.

Bobadilla, for one, is not optimistic about what the already overstressed governments will be able to do. "The fact that the elderly are going to be poor and are going to be many," he says, "doesn't [automatically] make them a priority."

—Constance Holden

## THE AGING BRAIN

# For the Cortex, Neuron Loss May Be Less Than Thought

Nearly everyone fears the changes that advanced age will bring to his or her mind. And some change is almost inevitable: As people get older, they become more forgetful and find learning new things more difficult. But careful study reveals that for healthy brains, as opposed to those beset by Alzheimer's disease, age-related changes are selective and hardly incapacitating. Movie plots are remembered, for example, even as their details are lost. Facts can still be learned, although their source may vanish. And now, in a departure from what was previously thought, several groups of neurobiologists are proposing that the biological changes in the healthy aging brain are similarly subtle—and possibly correctable.

Just a decade ago, almost all experts thought that widespread cell death in the brain caused the cognitive changes of normal aging. But

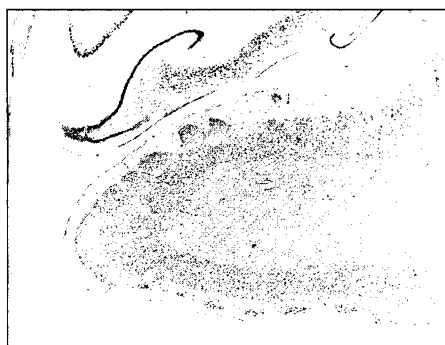
text, the brain area governing much of human cognition. A similar picture may also be emerging for the hippocampus, a structure important in memory (*Science*, 1 March, p. 1229). "The field of [brain] aging is undergoing a major reassessment," says neuropsychologist Mark Moss of Boston University School of Medicine. "It's an exciting time."

That reassessment is still incomplete, as not everyone thinks that the new data, some of which haven't yet been published, have proved that cortical neurons are preserved during aging. "There's no definitive study on cell loss and normal aging," says neurobiologist Paul Coleman of the University of Rochester School of Medicine and Dentistry in New York. "It's a messy area." But if the new findings are correct, they might have implications for developing drugs that bolster aging memories.

That's because it might be possible to compensate for some of the other brain changes being considered as contributors to the cognitive deficits of age. They include, for example, a decrease in the density of certain of the receptor proteins through which neurons respond to neurotransmitter signals and a breakdown of myelin, the fatty sheath that insulates nerve fibers and thereby facilitates their ability to transmit signals. Such alterations, unlike actual neuronal loss, might be remedied with drugs. "If the brain is preserved structurally, there's hope that we'll be able to reconstitute its function [with drugs]," says Bradley Hyman, a neuroscientist at Massachusetts General Hospital in Boston.

The long-standing belief that neurons are lost during aging got its major impetus in 1955, when anatomist Harold Brody at the State University of New York, Buffalo, published the first study correlating neuronal counts in the neocortex with age. Studying brains from 20 human subjects, from newborns to 95-year-olds, Brody saw extensive cell loss in a number of neocortical areas, including the cognitive areas of the frontal and temporal cortex. Follow-up studies by Brody's own group, as well as by several others, indicated that the cortex could lose up to 40% of its neurons during aging.

Although no one knew for sure how such massive cell death related to mental ability, experts thought it could cause rather dramatic declines in cognitive abilities in the normal, healthy elderly. Additionally, it



**Normal versus diseased.** An Alzheimer's brain (*above*) shows extensive neuronal loss in the entorhinal cortex compared to a normal brain (*below*).

in the past few years, better methods of telling normal subjects from those with neurodegenerative diseases and more sophisticated techniques for examining the brain have started to yield results challenging that notion—especially for the neocor-

PHOTOS BY BRADLEY HYMAN