Chapter 1

Executive Summary

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Introduction

This century is witnessing unprecedented demographic and technological changes in American society. There have been significant gains in life expectancy, both at birth and at the older ages. Declining fertility rates have "aged" the U.S. population, and there have been major improvements in health status.

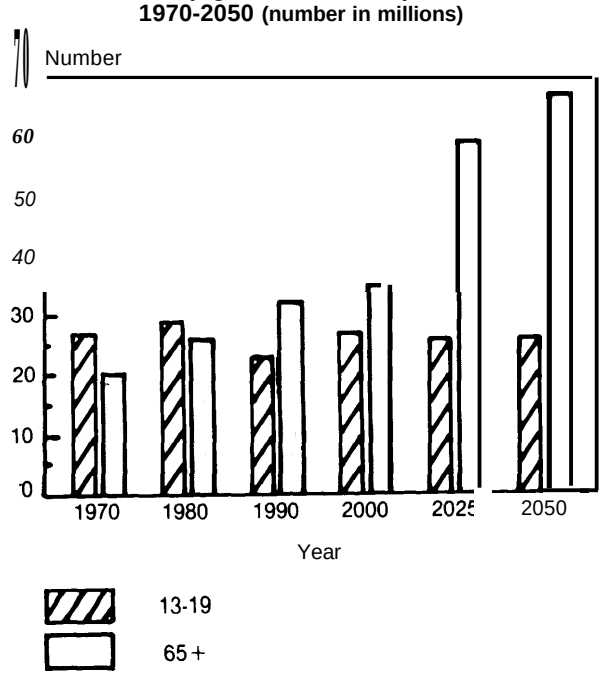
By 1980, for the first time in the history of the United States, 50 percent of all Americans were over 30. Today there are more persons over 65 than there are teenagers. The elderly population has grown from 4.0 percent of the total in 1900 to mm-e than 11.5 percent in 1983. The number of those over 65 is projected to grow from today's 27 million-to an estimated 39.3 million by 2010, when they will constitute almost 14 percent of the Nation's population.

More significantly, between 2010 and 2020 the older population is expected to increase by more than 12 million, when the first wave of the baby boom cohort becomes the elderly boom of the future. By 2025 there will be more than twice as many older Americans as teenagers (see fig. 1). These demographic trends are due in large part to technological changes since 1900-changes whose pace is accelerating. This technological revolution has major implications for all aspects of society.

During this century, improved technologies have increased life expectancy at birth from an average of 47 years in 1900 to more than 74 years in 1982, These technological improvements include advances in public hygiene and sanitation, reductions in the prevalence of infectious diseases through immunization and antibiotics, and the continued improvement and accessibility of general health care to all persons. The effects of these advances have been most noticeable at the earliest ages, where dramatic improvements have increased the probability of surviving beyond the first year of life. Almost four-fifths of all babies born this year can expect to live to age 65; only two-fifths of babies born in 1900 could expect to do 80,

More recent technological advances have helped reduce mortality rates at the older ages. During the past 15 years, sharp reductions in death rates from two major killers-heart disease

Figure I.— Number of Teenagers (Aged 13 to 19) and Older Persons (Aged 65 and Over), United States, 1970-2050 (number in millions)



SOURCE: Population Reference Bureau, Population *Today,* vol. 12, No. 1, January 1984.

'For purposes of this assessment, the elderly population is generally defined as all persons aged 65 and over, although in designated cases the age identifier can be as low as 40 years or as high as 85 years (the very old).

Technology" is broadly defined here to include the development of knowledge and its application to solving practical tasks and problems; it also refers to such factors as biomedical research into the causes of arthritic conditions, as well as wheelchairs used by persons suffering from severe arthritis. Technology can be "soft" (research and knowledge) or "hard" (products of research), and "high" (complex) or '(low" (simple),

and stroke—have caused mortality rates among the elderly to plummet. Death rates fell more sharply during this period than during any 15-year period in U.S. history. More than half of the improvement in life expectancy for the elderly since 1950 has occurred in the past decade. Recent age-specific mortality rates indicate that this accelerating pace of improvement in life expectancy at older ages will continue for the foreseeable future. The most dramatic changes are the increases in the proportions of people surviving to the oldest ages (i.e., **75** or **85 years). Other** technologies may lead to changes in the aging of cells that could have consequences for the human life span,[3] as discussed in chapter 2.

The '(newness') and swift pace of these gains in" life expectancy at older ages signify a new era in the changing demographic structure of the United States that has important consequences for all aspects of society. This era is also characterized by rapid technological advances in the ability to plan fertility[4] (e.g., oral contraceptives, intrauterine devices), enabling individuals to more closely realize their childbearing preferences. The post-World War II baby boom was abruptly succeeded by the "baby bust" of the last decade. Fertility has been as important a factor as mortality in determining the changing age structure of the Nation's population. Among the significant and unprecedented demographic changes of recent decades are:

- dramatically lower fertility rates among women of childbearing age, a trend that began in the late 1950s and recently stabilized at a rate below replacement level (see fig. 2);
- similarly dramatic reductions in infant and neonatal mortality rates[5] over more than half a century that are approaching an expected minimum possible level (see fig. 3); and
- sharp declines in the age-adjusted death rates[6] of the total population since 1930 (see fig. 4).

In combination, these demographic trends have produced an aging population that is characterized by accelerating increases in life expectancy at the oldest ages. Moreover, the gains in life expectancy at birth and at older ages have consistently been greater for females than males; there are now 5 million more older women than older men in the United States.

The effect of technology on population structure is expected to continue. For example, the median age, which rose only 0.6 years between 1960 and 1980, is expected to rise by 3.3 years between 1980 and 2000. That this significant demographic shift will occur during such a short interval underscores the increasing pace of population aging in the United States. Potential consequences include changes in the structure of families, more older persons living alone (four-fifths of them women), more older workers, and a growing market for services and products to the elderly. In general, this profound demographic transformation is likely to change both the resources older persons have to offer and the allocation of resources offered to them.

These changes may occur even faster than is currently anticipated. Previous demographic projections have underestimated the rate of change in population aging due in part to difficulties in anticipating the development of new technologies and their short= and long-term effects on fertility and mortality.[7] The phenome-

'('Life span" is the biological upper age limit that a human can potentially reach, currently considered to be about 120 years.

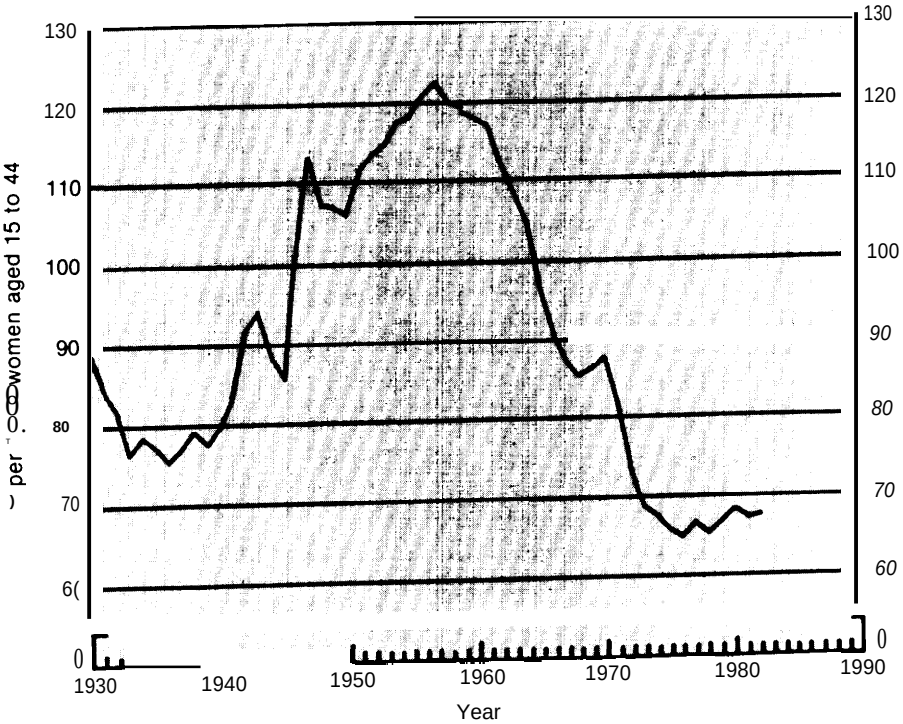
4'Fertility is a measure of the number of live births within a population, such as "number of births per 1,000 women aged **15-44".** Fertility measures do ***not*** account for stillbirths and aborted pregnancies, whether induced or spontaneous.

The current U.S. infant mortality rate of 10.9 (deaths to infants under 1 year of age per 1,000 live births) ranks 14th in the world, The lowest rates are 6.5 in Finland and 6.8 in Sweden, while many developing countries have rates well above 100 (e.g., 134 in Nigeria and 153 in Liberia). Thus, the ***relative*** possible improvement in the U.S. infant mortality rate is very small when compared with rates in most other countries.

'In contrast to "crude rates," '(age-adjusted" rates control for the effects of age-structure differences in a population over a period of time. Analogous to the use of "constant dollars" in economic analyses, they are the best indicators of actual change in demographic rates over time.

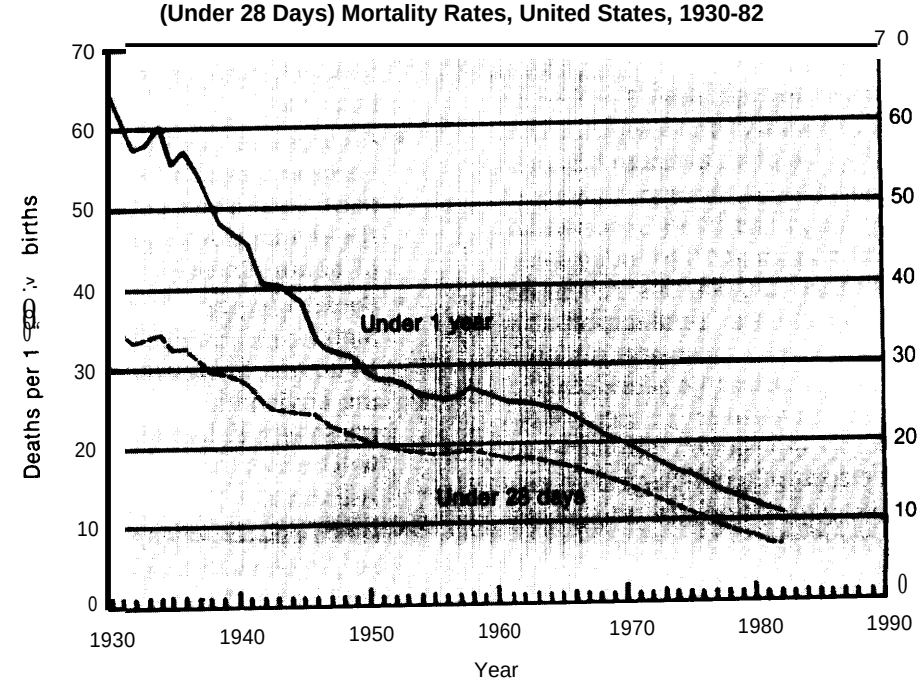
The Bureau of the Census projections for the older population have consistently underestimated the number of older persons in future decades. For example, in 1977 the bureau attempted to account for changing mortality rates among the elderly by increasing its 1975 projections of the older population for 2000 from 28.8 million to 31.9 million. The latest revisions are for almost 34.1 million elderly in 2000. In less than a decade the projections of this population have been increased by 18 percent in response to the most recent effects of technological advances in health and medical care.

Figure 2.—Fertility Rates per 1,000 Women Aged 15 to 44 Years, United States, 1930-82



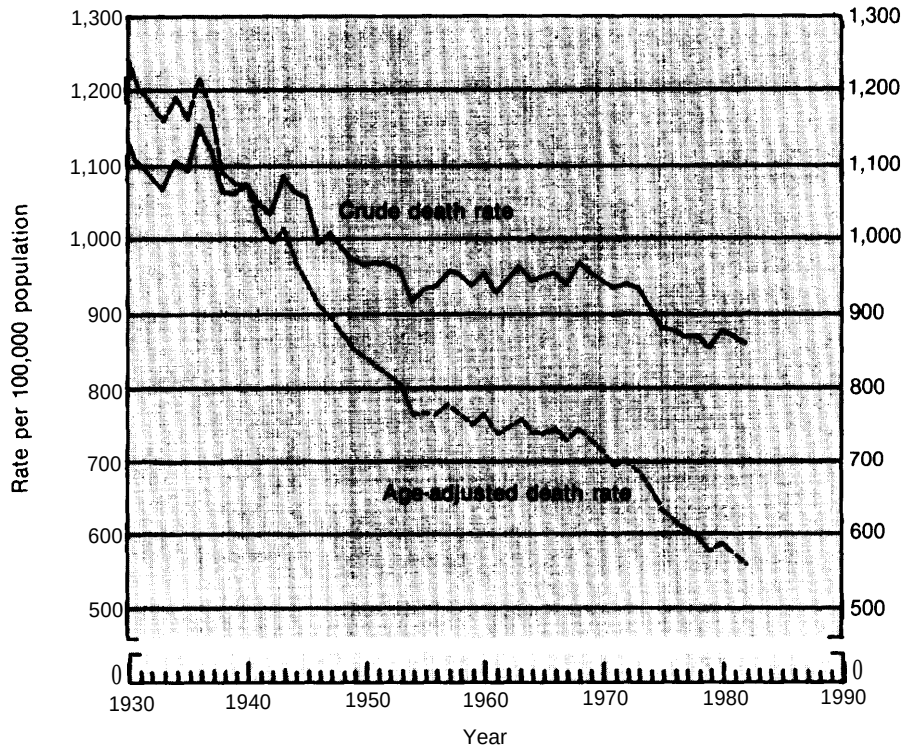
SOURCE: National Center for Health Statistics, "Annual Summary of Births, Deaths, Marriages, and Divorces: United States, 1982." Monthly Vital *Statistics Report, vol.* 31, no. 13, DHHS publication No. (PHS)83-1 120 (Hyattsvine, MD: Public Health Service, October 1983).

Figure 3.—infant (Under 1 Year) and Neonatal (Under 28 Days) Mortality Rates, United States, 1930-82



SOURCE: National Center for Health Statistics, "Annual Summary of Births, Deaths, Marriages, and Divorces: United States, 1982," Monthly Vital Statistics Report, vol. 31, no. 13, DHHS publication No. (PHS)83-1 120 (Hyattsville, MD: Public Health Service, October 1983).

Figure 4.-Crude and Age-Adjusted Death Rates, United States, 1930.82



SOURCE: National Center for Health Statistics, "Annual Summary of Births, Deaths, Marriages, and Divorces: United States, 1982," Monthly *Vital Statitics Report, vol.* 31, no. 13, DHHS publication No. (PHS)83-1 120 (Hyattsville, MD: Public Health Service, October 1983).

nal pace of current changes is readily apparent in other areas of technology. For example, a microprocessor measuring less than 3 inches on a side now has the capability of a computer that 20 years ago was the size of an average business office. The rate of increase in storage capacity of computer memory chips has been exponential, rising from the 1-bit chip in 1970 to today's current chip with more than 250,000 bits; recent development of an experimental l-million-bit chip indicates that its commercial mass production is only a few years away. Dramatic technological changes such as these have future consequences that can only be partly envisioned. Similarly, although the societal effects of technological change and the aging of the population are only partly foreseeable, they are likely to be felt in various ways:

- Changes ***in health status.*** The prevalence of chronic illnesses and attendant functional impairments among the elderly will rise as the proportions of those in the oldest subgroups increase.
- ***Changes in health services.*** The need for social and health care services (i.e., long-term care) for chronic conditions will grow, as will the demand for medical care for treatment of acute illnesses.
- ***Social changes in the living environment.*** Significant changes are expected in family structure, living arrangements, and the housing environment of the elderly; more older persons will live alone, and people over 55 will be more likely to have a very old parent still alive.
- ***Work-related changes.*** older workers may be particularly vulnerable to the impact of new methods of production and workplace technologies, and to changes in the skills required of the labor force.

This assessment describes the reciprocal relationship between technology and aging in America by focusing on these four general topics. Changes in these areas are interdependent and offer both broad challenges and striking opportunities to society. The balance of this chapter summarizes the major components of this study and highlights its major findings. Selected issues arising from each area are presented for congressional consideration. Full development of the issues and possible congressional options are contained in chapters 3 through 10.

Definitions and focus

In keeping with congressional requests and the advice of the Technology and Aging Advisory Panel, the term technology is broadly defined in this assessment. It is viewed as both a collection of devices or gadgets (i.e., hard technology) and the development of knowledge or an organizational system (i.e., soft technology). The two types of technology form the ends of a continuum. Within the continuum, the most relevant types of technology have been selected for each of the substantive areas. Knowledge and research are thus stressed in some instances, and hardware and devices in others.

Another dimension of technology is its degree of complexity, which can range from simple "low-technology" devices such as stair safety treads to complex "high-technology'l equipment such as the computerized axial tomography (CAT) scan used for medical diagnosis. The range of technological complexity and types leads to different approaches and findings for each major subject of this assessment, which accordingly covers a variety of issues and options for congressional consideration.

A general theme, however, prevails throughout. The most important variable in this assessment of the relationship between technology and aging is the physical and mental functioning of older persons. Most people do not fear '(growing old" so much as they fear becoming chronically ill or frail The "vitality') of older people-their ability to remain functionally independent, or to be minimally dependent on various types of assistance-is the fundamental characteristic that determines their quality of life at home, in the workplace, and within the community. The extent to which various technologies can improve the ability of older persons to maintain this vitality is a major focus of this report.

Changes in health status

*population aging and changes in selected chronic conditions **

The second half of the 20th century has seen a dramatic shift in the types of diseases afflicting people, especially in technologically advanced countries. The incidence of many infectious diseases has fallen sharply as sanitation has improved and vaccines have been developed; many of the remaining infectious diseases can be effectively treated with antibiotics. Death rates from diseases of the heart and blood vessels have also begun to change as a result of diet, personal hab - its, and improved health care. If these trends continue, several predictions can be made:

- life expectancy at older ages will continue to rise, as will the median age of the population;
- diseases whose incidence rises with age will become more prevalent;
- environmental, behavioral, and dietary factors affecting health may become more important because individuals will live through longer periods of exposure and have more time to develop symptoms; and

● These issues are examined in detail in chs. 2 and 3 and app. A.

. new and unexpected medical problems may appear.

As death rates from vascular diseases decline, the prevalence of other chronic health conditions such as dementia, arthritis, cancer, deafness, poor vision, and other currently incurable and unpreventable ailments is likely to increase. The progression from infectious to cardiovascular to other chronic conditions has followed the path of clinical ignorance; the disorders that are now most common are those about which the least is knowm Far more is understood about the cause of tuberculosis (now rare) than about the causes of Alzheimer disease* (the most common disorder causing dementia among the elderly).

There are four general strategies for dealing with chronic health conditions:

treatment of acute episodes of illness arising from underlying chronic illness;
- long-term medical treatment or long-term care;
- prevention; or
- research to improve diagnosis, treatment, and prevention.

Each of these strategies is influenced by Federal policy; a balanced approach is required for effective control of chronic disease. Current Federal policy tends to favor acute care over preventive strategies, long-term care, or research. In surveying the conditions that most affect the elderly population of the United States, OTA, with the assistance of the Technology and Aging Advisory Panel, chose five conditions as especially worthy of review, using the following seven criteria:

- the condition is an important cause of death and disability among the elderly population due to severity or prevalence;
- the condition is chronic and persistent among the elderly;
- the impact on caregivers, including family members and friends, is a significant hardship;
- the condition contributes to functional impairment and the demand for long-term care, a major focus of this assessment;
- easily readable and up-todate summaries of the state of science and medicine regarding the condition are not readily available;
- technology is relevant to correction of or compensation for the condition; and
- Congress has recently demonstrated a special interest in the condition.

The five chronic conditions reviewed are de mentia, urinary incontinence, hearing impair ment, osteoporosis, and osteoarthritis

Dementia was selected because Alzheimer disease and other dementing illnesses will become overwhelming health problems unless means for prevention or treatment are found. These diseases are severe, affect an important aspect of human function–mental ability-and are the most common determinants of need for long-term care. There are as yet no reliable or specific means of accurately diagnosing dementing disorders, although improvements have been rapid in recent years. Further, these disorders are probably not single entities, but combinations of related but biologically distinct diseases that have not yet been scientifically differentiated.

The main policy options relating to Alzheimer disease and dementia thus concern long-term care for demented patients and biomedical research. Although the ultimate solutions to dementing illness must come from research, they are not likely to be achieved in the short term, despite recent advances in knowledge of these conditions; the problem of caring for demented patients for the final years of their lives will be very great for a number of years to come. The social and economic value of successful research in this area is enormous.

Urinary incontinence is a growing problem among the elderly, and is another major reason for institutionalization. It is a common symptom of different neurological, endocrine, vascular, and urological diseases that can now be treated with technologies ranging from absorbent pads to sophisticated mechanical devices and surgery. Difficulty persists in diagnosing the condition among the noninstitutionalized elderly, who often do not

This assessment uses the term “A1zheimer disease” (instead of the more familiar “Alzheimer’s disease”) in accord with recommended usage by the American Academy of Neurology and the American Neurological Association and their respective journals.

seek medical attention or do not admit to what can be an embarrassing problem. Because many of the relevant technologies are just coming to fruition, incontinence should be far more effectively treated or managed in the future. [9]

Discussion of the problem of incontinence and potential policy issues centers on the substantial delay in developing appropriate technologies, as well as possible drawbacks of present technologies. Improvements in this area could notably reduce the nursing home population and permit families to directly care for their incontinent dependents for a longer period of time. Equally important would be the great improvement in the quality of patients' lives.

Hearing impairments affect almost 30 percent of all older Americans; 23 percent of those aged 65 to 74 and almost 40 percent of those over 75 suffer some hearing loss. Most hearing impairments of the elderly cannot be corrected with available medical or surgical techniques, but technologies such as hearing aids and assistive listening devices can compensate for some forms of hearing loss. But the adaptation of appropriate technology to specific hearing defects of patients, especially elderly patients, has had limited success. The potential for improvement of hearing is substantial if diagnosis is made early enough, if patients can be convinced of the value of correction, and if industry can adapt to better serving patients' needs .10 Technological innovation in this area promises to be rapid over the next decade.

Federal policy issues include assurance of patient safety in public places (e.g., mandating alarms that can warn those with hearing impairments of danger), reimbursement policy for Medicare and Medicaid (which currently offer little support for those with hearing impairments), increased regulation of the hearingdevices industry, and sponsorship of training and research.

Osteoarthritis, which affects 16 million to 20 million older Americans, is the largest single cause of disability among the elderly. Radiologic evidence of osteoarthritis is found in over four-fifths of persons over 70. Technological issues related to osteoarthritis include a relative lack of basic scientific knowledge about the biology of cartilage, a need for preventive strategies, the potential for reducing pain and suffering for a large proportion of patients, and the enormous expense of current therapies, particularly joint replacement surgery. Like dementia, osteoarthritis is in need of expanded research that could lead to discoveries for effective prevention and cure.

Osteoporosis is a disease process involving thinning of bones. Its most devastating consequences are fractures of the vertebrae and long bones, which are especially common in elderly women. Fractures of the hip often result in death or extended periods of rehabilitation, chronic impairment, or nursing care. Current evidence suggests that osteoporotic fractures are amenable to prevention by such methods as increasing calcium intake and postmenopausal administration of estrogens, but a definitive preventive protocol has not been established because the various regimens used in routine practice have not yet been rigorously compared.

SELECTED ISSUES*

Effective treatment or prevention of these five chronic disorders is needed, and adaptation of technology to compensate for the ravages of chronic disabilities will be increasingly in demand in future years. For conditions that can be ameliorated by existing technologies, such as some types of hearing impairments and incontinence, the availability, application, and improvement of such technologies is a priority. Other policy considerations include possible oversight to promote increased awareness and sensitivity to the extent of chronic illnesses among the elderly and the possibilities for their management.

Research on chronic diseases, however, provides the only possibility for their ultimate elimination. For this reason, two general issues merit congressional attention:

[9] This subject if more fully discussed in the forthcoming OTA case study on "Technologies for Managing Urinary Incontinence" (January 1985).

[10] For a detailed review, see the forthcoming OTA background paper on "Management of Hearing Impairment in the Elderly" (January 1985).

*For brevity, only the most important issues for congressional consideration are presented in this chapter. These and other issues, each with a number of options, are discussed in greater detail in their respective chapters. See ch. 3 for further discussion of the issues in this section,

- ***Should Congress increase support for basic and clinical biomedical research and for longitudinal studies on aging and chronic diseases?***
- ***Should Congress exercise more or less control over the extent, direction, and selection of problem areas of basic biomedical research related to aging?***

Health promotion/disease prevention and nutrition *

An increasing body of evidence demonstrates that preventive measures begun early and maintained throughout life can significantly reduce the prevalence of acute and/or chronic disease in old age. Preventive measures are considered here in the context of persons over 65, while recognizing the importance of preventive measures throughout life.

Until recently there was consensus among health professionals, and among the elderly themselves, that after 65 it was too late to think seriously about prevention of disease or disability. These attitudes are slowly changing, and health promotion is now justified on the basis of rising life expectancy ***after age*** 65 (on average, currently more than 14 years for men and 18 years for women more sophisticated definitions of health that recognize variability among and between age groups, and recent improvement in cardiovascular disease mortality due to preventive efforts (e.g., control of hypertension and elimination of smoking).

The goals of health promotion/disease prevention vary with personal circumstances. For those who are ill, the hope is to maximize function and prevent deterioration; the goal of those who are well is to prevent disease or disability at any age.

MORBIDITY, MORTALITY, AND RISK FACTORS RELATED TO CHRONIC DISEASES

Diseases of the heart, malignant neoplasms (cancer), and cerebrovascular disease (stroke) accounted for three-fourths of all deaths among the elderly in 1981. The incidence of these major diseases remains high, but death rates from most have decreased for the elderly. As more older persons survive acute episodes of stroke and coronary heart disease, the prevalence of these diseases rises. Because the burden of morbidity in the older population is rising, this assessment examines the risk factors 1l that are correlated with these diseases and chronic conditions.

CORONARY HEART DISEASE AND STROKE

A cluster of risk factors correlates both with coronary heart disease (CHD) and stroke, Hyper= tension, or high blood pressure, is the most powerful predictor of risk for CHD; more than half of persons with myocardial infarction and three-fourths of patients with stroke have concurrent hypertension. *z Limited findings indicate that control of moderate and high diastolic hypertension in older individuals is associated with reduced mortality and morbidity from CHD and stroke, but the benefits of treatment of isolated systolic hypertension remain unclear and are under investigation.

Cigarette smoking is highly correlated with mortality from cardiovascular disease; it is also a significant factor in morbidity, exacerbating hypertension (nicotine constricts the blood vessels). Hypertension, in turn, is another risk factor for CHD and stroke. Unfortunately, the elderly often succumb to the myth that smoking cessation is effective only for younger age groups. Now that those who reach 65 can expect to live an average of 16 more years, the benefits of not smoking are substantial. Programs and research on smoking cessation should be expanded to give greater emphasis to their impact on older individuals.

Despite gaps in knowledge, it appears that exercise can benefit the elderly in reducing their risk of CHD and stroke. Some gerontological studies indicate that carefully developed exercise regimens for older people can reduce blood pressure and pulse rate at rest while also increasing

*These issues are examined in detail in ch, 4 and app. C.

[11] Risk factor 5 are characteristics that indicate an increased likelihood of developing a given condition. They are based on statistical probabilities in large populations rather than on causal relationships or the certainty that an individual will develop a specific disease or condition.

[12] Hypertension in the elderly is defined as blood pressure greater than 140/90mm Hg or isolated systolic blood pressure greater than 160, with normal diastolic blood pressure.

Photo credit: Dennis Deloria, Dancers of the Third Age, Dance Exchange, Washington, DC

Properly developed exercise programs can benefit one's health at any age.

aerobic capacity. Exercise reduces fat and increases lean body mass, and can promote healthy bone. Yet exercise carries certain risks and, especially for the elderly, should be gradually initiated according to individual health characteristics. The risks depend on a number of factors—general health, past exercise habits, age, type and amount of exercise, and intensity of exercise. Nevertheless, when weighed against the hazards of not exercising, the benefits clearly outweigh any risks. More information needs to be developed regarding the relative risks and benefits of different levels of exercise for older persons, particularly those suffering from chronic conditions.

Although stress is a normal part of life, little documentation exists regarding the prevalence, types, and effects of stress on older persons. A possible indicator of stress is the prevalence of depression, the most common mental problem among older people. Depression is one symptom of the inability to cope with stress, which can cause various types of health impairment. Stress-reduction techniques—such as exercise, meditation, and relaxation+an reduce the physical and psychological effects of stress. Biofeedback techniques can also help minimize the negative consequences of stress. In severe cases, prescription drugs are also effective treatments.

As with exercise, a considerable body of knowledge remains to be developed regarding the specific characteristics of stress and its consequences for the elderly.

Nutrition, including intake of liquids, appears to have special significance for older persons. Poor nutrition results in a lack of essential vitamins and nutrients, which leads to physiological deficiencies. Poor nutrition can also be manifested in an excess of certain nutrients that are related to obesity, [13] to higher risk of diabetes, and to higher levels of cholesterol—all of which are risk factors for CHD and stroke. Insufficient intake of liquids can lead to dehydration, which is often undetected for long periods, Among the elderly, changes in metabolism and physical activity can significantly alter the intake, absorption, and effective utilization of various nutrients. There is as yet too little information, however, on which to base Recommended Dietary Allowances (RDAs) specifically for the elderly population. It is particulary difficult to discern the long-term subclinical deficiencies that may be related to the aging process.

Current Federal policy, as implemented under the older Americans Act, is designed to improve the nutritional status of the older population through the congregate meals and meals-on-wheels programs. Existing evaluations of these programs are methodologically flawed and provide insufficient information about the programs' effectiveness in reaching the at-risk poor and minority elderly. Future evaluations should also focus on the nutritional value of the food actually consumed rather than on just the food that is prepared.

Impaired glucose tolerance is symptomatic of diabetes mellitus, which is in turn a risk factor for cardiovascular disease. Moreover, diabetes is strongly associated with obesity, especially as age increases. Drug therapy can reduce glucose levels and promote management of diabetes, but its efficacy in CHD prevention is unclear. Dietary restrictions are also used in management of CHD, but little is known about possible ways to prevent or minimize its incidence.

High serum cholesterol levels, which are related to diets high in saturated fats, have recently been linked with atherosclerotic diseases of the blood vessels. A study of men aged 35 to 59 with very high levels of cholesterol who were given drug therapy to reduce those levels found a significantly lowered incidence of CHD. However, no direct causal effect can be inferred concerning the effect of reduced dietary levels of saturated fats for those with moderately elevated cholesterol levels, since the research involved men with high levels of cholesterol who were treated with drugs. More clinical and longitudinal investigations are required to clearly understand the relationship between diet and moderately high levels of cholesterol in the older population.

[13] Obesity is generally defined as weight that is 20 percent higher **than** specified in standardized tables according to sex, age, and height. Obesity itself is associated with numerous risk factors for CHD and stroke.

CANCER

Cancer, the second leading cause of death among the elderly, is associated with risk factors such as smoking and diet, although it remains difficult to establish specific causal links from available analyses. If detected early enough, cancers of the prostate, breast, lung, rectum, and colon can be effectively treated. Regular medical checkups and self+xamination are very important factors in early detection of cancer. Unfortunately, some studies indicate a reluctance among the elderly to seek screening services, particularly gynecological examinations for older women. This may be due to ignorance or lack of information about new technologies and the possibilities for treatment of many diseases, including some cancers. Careful monitoring of changes in the body is important, because multiple presentations of illness in the elderly can mask the existence of some diseases and make early detection difficult.

FRACTURES

Osteoporosis is the cause of about two-thirds of hip fractures in older people, especially women. Research to prevent osteoporosis is centered on the effectiveness and possible risks of estrogen replacement therapy after menopause, supplemental doses of calcium for women both before and after menopause, and the role of exercise in bone-strengthening. Up to 40 percent of the elderly report suffering a fall. Two-thirds of these are estimated to be preventable, and as many as half may be caused by environmental factors such as loose rugs, poor lighting, slippery surfaces inside and outside the home, broken stairs, or lack of grab-bars in bathrooms and other high-risk

areas. The likelihood of falls is increased by underlying physical conditions such as Parkinson's disease, seizures, cerebrovascular disease, and conditions that cause fainting or dizziness (including inappropriate use of drugs). Sensory loss in hearing and vision also increase the risk of falls.

The incidence of falls and the severity of their consequences for the elderly could be reduced by better diagnosis and treatment of these chronic conditions and efforts to eliminate environmental hazards. Concerted efforts are required to sensitize the general public and the elderly themselves to the possibilities for greatly reducing the risk of falls, and the suffering and expense they can cause.

DENTAL DISEASE

An often overlooked problem for the elderly is dental disease. In 1971, about 45 percent of Americans over 65 were estimated to have lost all of their teeth. Loss of teeth is associated with poor dental hygiene, a diet high in starches and simple sugars, and lack of regular dental care. Dental diseases, including those of the gums and bone, can have significant consequences for the general health of the elderly. Yet in 1981 approximately half of all older persons who had teeth had not visited a dentist in the previous 5 years.

Improved monitoring of dental health for the elderly and the application of new technologies for prevention and treatment of dental disease should be fostered. Medicare reimbursement is not provided for any preventive dental services, which may be a reason for the extent of inadequate dental care among the elderly.

SELECTED ISSUES

Each of these areas of health promotion/disease prevention and nutrition requires additional information and research regarding their long-term effects on the well-being of older persons. Understanding the interaction of individual health behaviors and environmental influences for promoting health into the older ages may provide new suggestions for preventing, coping with, or at least delaying the onset of chronic diseases. A substantial research effort over an extended period of time is needed to achieve this definitive knowledge.

Most current RDAs do not differentiate between subgroups over age 50. The same RDA is supplied for all ages past 50, regardless of nutritional need. In general, RDAs fail to take into account the age-related physiological, behavioral, and pathological changes that can affect the nutritional needs of those over 65. Certain nutrients are especially relevant to the aging process and should be stressed in research on elderly nutrition; these include calcium, vitamin D, B vitamins, vitamin A, zinc, sodium, and fats.

other specific issues for congressional concern include these questions:

- ***Does research on health promotion interventions for the elderly indicate that these interventions are cost effective?***
- ***Should Medicare reimbursement categories be reconsidered with a view to increased reimbursement for health promotion/disease prevention interventions?***
- ***How might Congress obtain more accurate and standardized evaluations of Federal food assistance programs in order to improve their general efficacy and their ability to reach specific target groups?***

*Medications and the elderly**

Drug treatment is an important medical technology for older individuals. Those over 65 use 30 percent of all prescription drugs—twice as many as the average user. More than four-fifths of all noninstitutionalized older people use over-the-counter medications. The safety of using medications, availability of information about drugs, and new technologies that might improve how drugs are delivered and used are influenced by Federal policy.

As disease prevalence rises with age, drug use increases. The elderly use the everyday drugs consumed by the general population for colds, acute infections, and headaches. Chronic diseases such as arthritis, hypertension, and cardiovascular disorders, which are especially common in old-

*This issue is examined in detail in ch. 5.

er people, determine the use of another group of drugs that includes diuretics, anti-hypertensives, anti-inflammatory agents, and cardiac drugs.

THERAPEUTIC EFFECTIVENESS OF DRUGS IN THE ELDERLY

When carefully administered, drugs improve the condition of most elderly patients. Drugs are usually the most cost-effective way to treat chronic disease or manage its effects. Such benefits, however, can have unanticipated negative effects on some older people. The elderly have a higher incidence of drug side effects and drug interactions than younger age groups. Many problems of drug use among the elderly are due to altered metabolism, the presence of multiple diseases, and increased susceptibility to side effects. The effects of these factors are exacerbated when older persons take improper combinations of drugs, often unbeknownst to their doctors or pharmacists.

Few drugs are tested for side effects and therapeutic effectiveness specifically in the elderly. Recent studies of how drugs are distributed and metabolized in the body show significant differences between older and younger populations. These differences are based on age-related biological changes that affect the body's ability to process, store, and excrete drugs. It is not yet universally recognized, however, that the elderly require different drug treatment than younger adults.

The presence of multiple chronic diseases and their treatment with multiple drugs lead to a higher incidence of adverse drug reactions and adverse drug ***interactions.*** The threshold of toxic blood concentration is lower for the elderly for many drugs, leading to increased probability of overdose, This may be due to altered pharmacokinetics[14] in combination with increased susceptibility to adverse drug effects.

While adverse drug reactions and interactions account for 3 percent of all hospital admissions, they account for 12 to 17 percent of hospital admissions for those aged 70 to 90. Adverse effects are especially common for drugs used to treat cardiovascular and psychiatric diseases, both of which are prevalent among the elderly. Adverse drug reactions among the elderly are estimated to cost $3 billion per year.

Side effects of drugs may be more common among ambulatory patients than among hospital patients. Reporting of adverse effects is less reliable for ambulatory patients, and drug errors are more common outside the hospital. Increased prevalence of home care may exacerbate the problem of adverse drug effects and noncompliance with prescription instructions.

EDUCATION IN PROPER USE OF DRUGS

Appropriate use of drugs by the elderly can be facilitated in a number of ways, Improved education of health care providers, including physicians, can instill knowledge about proper use of drugs and increase awareness of the special biological and physiological characteristics of older patients, An experimental method now under way uses trained personnel to visit physicians to educate them about common prescription errors.

There is wide agreement on the need to improve physicians' awareness of drug therapy problems among older patients. A large study found that efforts to change physician habits reduced Medicaid costs significantly. The cost of educational materials and personnel for educating physicians was $93 per physician per year, which resulted in estimated annual savings of $205 **per** physician in Medicaid reimbursements.

Patient education is essential for the practical management of chronic conditions because the long duration of illness requires active patient participation. Information transfer is more difficult with older patients than the general population, however, especially for two groups-very old persons who are less educated and those who are confused. Heightened sensitivity among health providers to the need for adequate patient education could improve the efficacy of treatment; enhanced awareness among older patients could diminish anxiety and aid in the treatment process.

TESTING AND SURVEILLANCE

Although drug testing in elderly patients is not specifically mandated for inclusion in clinical trials

[14] pharmacokinetics defines how drugs are distributed and metabolized in the body.

performed for Food and Drug Administration approval, the recent trend has been to include more older patients. But there are no specific guidelines or regulations for assuring that clinical trials take account of the special drug needs of the elderly, in part because such requirements would complicate analytic procedures. Elderly subjects would have to be representative of the older population and its wide variety of chronic conditions. The high prevalence of disease among the elderly increases the "noise" level in drug reaction data, compounding the difficulty of detecting problems. To compensate for this factor, more elderly patients must be included in tests; this increases development costs and makes analysis more difficult.

Increased use of postmarketing surveillance could contribute to establishing drug safety and efficacy; monitoring of actual drug use would help to identify unknown adverse reactions. Premarket test results could be supplemented by these procedures and safety would be encouraged by intensive surveillance. There are, however, problems with using postmarketing surveillance to assure safety; current methods of reporting adverse effects, for example, are unreliable.

Because older people often have multiple disorders that can be treated in a multiplicity of ways, and because of the plethora of potentially effective drugs that can be used, optimal treatments are often not apparent. Comparative studies of different treatment combinations for a set of conditions are often not available. The standard method for dealing with such uncertainty is the randomized clinical trial, the development of which was a major advance in modern medicine. Careful studies of different treatments under controlled circumstances could establish the best regimens.

Federal savings from support of randomized clinical trials might be obtained through reduced incidence of side effects from current treatment methods and by preventing unnecessary complications. The magnitude of savings, however, cannot be estimated because there is inadequate knowledge about the potential improvement in health that might arise from different treatments. Also, increased support for clinical trials is likely to be quite costly, and could divert Federal funding from basic biomedical and other forms of research.

SELECTED ISSUES

It is clear that considerable information is needed about issues surrounding drug use by the elderly. The Federal Government is directly or indirectly involved in a number of these issues. Considerations for congressional review include the following:

- ***Should Congress require premarket testing and/or postmarked surveillance of drugs specifically in older population subgroups?***
- ***How might Congress encourage improved education of both health care providers and older persons themselves regarding drug use by the elderly?***
- ***Should Congress require improved labeling of over-the-counter medications to warn of possible dangers in their use by older persons?***
- ***Should Congress extend funding for randomized clinical trials for drug treatments for diseases that are prevalent in the elderly?***

changes in health services –

*Information technology and health care of the elderly**

Ability of the elderly to use information technology and to participate more directly in their health care is of growing interest as new appreaches to health promotion, disease prevention, and home health care are developed. Although information technology, particularly in computers and communications,[15] has had substantial impact on the health care system, relatively little atten-

*This issue is examined in detail in ch. 6.

[15] For purposes of this report, information technology is defined as the application of computers and telecommunications systems to the creation, storage, manipulation, and dissemination of information,

tion has been devoted to applying this technology to the specific health needs of the older population, who stand to benefit significantly from its applications. This report thus focuses on the ***potential*** use of health information technology for both current and future cohorts of older persons. The elderly of the year 2000 will have considerably higher educational levels, and be more likely to be familiar with and to use information technology than those presently over 65. The difference in attitudes toward such technology will be even more dramatic when the baby boom cohorts, now aged 25 to 40, become eligible for Medicare early in the 21st century.

Although there is a dearth of computer applications of information technology for elderly persons in general, various computer-based technologies have been developed to assist the severely disabled and those suffering from chronic medical problems. Such prosthetic technologies include programmable wheelchairs, voice-activated robots that can literally "serve" paralyzed persons, and a variety of rehabilitation aids. Many of these technologies, however, are as yet either experimental, relatively expensive, or primarily applicable in health care settings.

New computer applications are expected to have widespread use in assisting those who are less impaired, including most older persons. The decade of the 1980s promises significant advances in the availability and use of personal computers for a multitude of functions that will aid all age groups in the population. Some of these new technologies will be especially beneficial to older persons who have decreased functional abilities and restricted mobility. Today, about half a million older persons are confined to bed; about 2 million have mobility problems around the home; and almost 3 million require the assistance of another person to perform activities of daily living. Information technology can enrich and improve the services that traditional health care institutions and professionals provide by disseminating information directly to older persons in their homes. This information could include methods for maintaining and improving health or ways to access needed services, and could be readily provided on video displays or in print, both to those at home and to wider audiences at senior centers, community centers, and congregate housing complexes.

USE OF INFORMATION TECHNOLOGY BY THE ELDERLY

There has been little study of the ability of older persons to use computers, and still less of their ability to use computers for health care. The little empirical evidence available indicates that—***contrary*** to stereotypical views of the elderly—most older individuals are quite receptive to computer technologies. Demonstration projects have shown that older persons, after preliminary instruction, have a high degree of interest in using personal computers. Some older people enjoy programming and working with applications software, such as spreadsheets; others prefer recreational computer games and communicating by means of computers adapted to their capabilities. Because the older population is heterogeneous, particularly in terms of functional ability, some older persons require specially adapted computers. Although they vary widely in cost at this stage of development and marketing, computer consoles with larger keyboards and video display screens with larger displays are available to compensate for the sensory and functional impairments of some older persons.

Information technology can be used by the elderly for health purposes in two major ways. One is computer-assisted health instruction, which is a logical extension of self-care/self-help. It is estimated that at least 25 self-help programs for the elderly are now in operation, most of them developed by nonprofit organizations, but very few of these use ***computer*** programs. Most computer-assisted health instruction programs are used in health care settings to instruct patients, such as diabetic and post-stroke patients, who have specific problems. The steady growth of software for educating the general public about health maintenance and disease management outside of traditional care settings, and the trend toward specialized programs for subgroups of the population, signal the eventual evolution of home-based computer programs for the elderly. The relevance of this technological trend for use by and for the elderly is not yet widely recognized by either the private or public sector, but the mar-

ket is expected to change rapidly during the next 5 years.

Self-help for health maintenance and disease management can also be ***indirectly*** assisted by existing computer technologies. Homes can be computer-monitored to assure proper heating, to control a variety of appliances, to provide wake-up services, and give audible reminders at medication times. Computers can be programmed to instruct older persons or their family caregivers on special diets, rehabilitation practices, and other medically related practices that promote their health. The safety of dependent older persons can be enhanced by alarm systems that notify central monitoring stations of trouble in the home. The alarm can be activated at any time by the individual or by an automatic signal if the monitoring unit is not reset within a predetermined amount of time. These and other technologies increase the ability of dependent older persons to remain in their homes and to be less dependent on personal care assistance.

A second important way in which the elderly can use information technology is by assisting health professionals to monitor the care of older persons. The use of home computers to augment professional care may enable chronically ill people to remain in their homes and reduce the need to make difficult visits tomedical offices or to have care providers visit them at home. Blood pressure, pulse rates, body temperature, and heart electrical activity can now be sensed and measured by "smart" sensors that incorporate microprocessors. This type of personal home health monitoring system can provide daily appraisals of the patient's vital signs and store the data in a longitudinal record that can be used to monitor changes in those measurements. It can also include a voice chip for giving simple instructions and programmed advice for certain types of health regimens.

Measurements of other physical functions have recently been developed for use in rehabilitating handicapped patients. Some of these measurements have the potential for computer-based processing, and may also be applicable for monitoring the health status of older persons who are acutely ill or severely impaired. An interactive telecommunications system between the patient's home and the health care provider's office could be established to facilitate medical monitoring.

ACCESS TO HOME COMPUTERS

There are no data on the age of individuals who own or have access to personal computers in the home, and estimates of future penetration of the market vary widely. Estimates of the proportion of U.S. homes that will have computers by 1990 range from one-fourth to two-thirds. It is only certain that the market will greatly expand, especially as unit prices decline and program capabilities increase. The extent to which this growth will reach the older market is unclear.

There are a number of barriers to the use of information technology for health purposes by the elderly. One problem is the cost of the technology, which currently ranges from several hundred to several thousand dollars for a basic home computer system. Additional costs for software increase the economic burden. Another factor is the incompatibility of equipment among a great variety of systems, making the decision to purchase a particular unit more difficult. The elderly with functional impairments have unique access problems in that they often find it difficult to use computers designed for the general public, and the costs of custom-designed units remain high.

Self-health information and computer instruction technologies are themselves emerging fields, and as such are diverse and unsettled. In some cases, programs are developed by transient "entrepreneurs" who lack subject knowledge and are often forced out of the market. Other programs have excellent material that is developed by individuals who have expertise in subject content and computer technology. Most available software programs have not been evaluated. The serious issue of establishing criteria for evaluating computer-assisted instructional material is just beginning to be addressed.

SELECTED ISSUES

Because the application of information technologies to self-health care for the elderly is new, there has been little direct Federal involvement in the past. Some Federal demonstration program

funds have been used to develop information system models for nursing homes. A more concerted Federal effort has supported research and development of information dissemination technologies for the handicapped, some of which are useful for older persons who are functionally impaired. Some executive agencies are now supporting demonstrations of home-based information technologies for health promotion; other agencies are considering funding investigations of the use of microcomputers and computer games to improve the social interaction and mental functioning of the elderly.

Additional research is needed on the role of information technologies in health maintenance and disease prevention for the elderly. This research should include evaluations of the quality of health instruction programs designed for older persons, problems in accessibility and use of computers by the elderly, and the cost-effectiveness and efficacy of information technologies for reducing the amount of personal home care required.

The major issues for congressional oversight in this area are:

- ***To what extent, if any, should the Federal Government be involved in activities concerning the safety, cost, liability, and efficacy of computer-assisted health instruction programs for the elderly?***
- ***Given existing authority, how can the Federal Government encourage the private sector to voluntarily develop appropriate health instruction technologies for the elderly that meet basic standards for*** quality?

*Functional impairment and long-term care **

Most older persons are able to carry on their regular daily activities in a variety of environments, but the incidence of chronic conditions and prevalence of functional impairments increase notably at the oldest ages. These problems are the major reasons for the long-term care needs of both the elderly who are institutionalized and those who live in the community. As the number of Americans over 65 rises, the corresponding rise in the number of "very old'' —those over 85–will dramatically increase the need for long-term care services, This need will be exacerbated by the new prospective payment system under Medicare, which is expected to limit hospital length-of-stay and encourage early release of older patients, many of whom will still require rehabilitative or other types of long-term care at home.

Long-term care services are provided by nursing homes, board and care facilities, and home health care agencies. In some communities additional services are provided in adult day care facilities, hospice programs, and congregate housing facilities. Little information is available about differences in the services that agencies provide or the types of older persons served, in part because of differences among State programs that support community-based long-term care services. It is known, however, that a wide range of services is provided to a great variety of older clients, and that there is both lack of coordination and duplication of services in many communities.

EXTENT OF NEED FOR LONGTERM CARE

In general, community-dwelling persons over 85 are ***six times*** more likely than those aged 65 to 74 to be dependent in basic or instrumental activities of daily living [16] and to need the assistance of another person. As the proportion of very old persons in the older population increases, the demand for long-term care services will grow. Greater strains will be placed on families and other informal caregivers, who currently provide up to 80 percent of long-term care for the elderly. This level of informal support is expected to change for a number of reasons:

- The older the person, the less likely he/she is to have a spouse to provide assistance; this is especially true for women over 85.
- The higher the number and severity of functional impairments, the lower the likelihood

*These issues are examined in detail in ch. 7.

[16]Basic activities of daily living include dressing, eating, bathing~ toileting, walking, and getting in or out of bed. Instrumental activities, also called home management activities, generally refer to tasks such as shopping, cooking, doing house and yard chores, handling money, and driving.

that family and friends can provide the degree of assistance required.
- Because most family caregivers are women, the increasing proportion of adult women in the labor force will reduce the number available to provide informal support to an elderly parent.

Greater demands will be placed on existing long-term care agencies to respond to the changing characteristics of the older population and its informal support network. Yet the complexity, fragmentation, and limited scope of long-term care services in most communities make it difficult for individuals and their families to understand what formal services and alternatives are available. The problem can be particularly troublesome for dependent older persons who are alone. One of the greatest fears of the elderly is that they may become frail and dependent on others, even though assistance might be readily available. This concern can be ameliorated by a logical and well-coordinated national system of long-term care services that includes expanded use of technologies in the health care setting, the home, and the community.

TECHNOLOGY AND LONGTERM CARE

Technology has not been widely used in long-term care services for the elderly. Identification of appropriate technologies for this population requires accurate assessment of their needs. Such assessment is hindered by the fact that Federal and State programs, which regulate and fund more than half of all long-term care services in the United States, influence the kind of needs that are recognized. By emphasizing medical and skilled nursing care, these programs tend to obscure the need for other types of supportive services.

Although existing medical technologies can treat some of the chronic conditions that cause functional impairment, most chronic conditions are not curable. Given the lack of effective cures or prevention, effective management of chronic conditions becomes important. This can often be achieved with appropriate drug therapy, personal care services, and use of technologies that compensate for decreased function (e.g., prostheses, assistive devices such as walkers, chair lifts, vision and hearing aids). Many of these assistance methods need further development to expand their usefulness. While biomedical research generally focuses on acute conditions that cause death, expanded research on the chronic conditions that cause functional impairment could result in effective treatments or prevention strategies, as well as prosthetic or management technologies that promote independence and decrease the need for long-term care.

Alternative approaches to maintaining independence or compensating for functional impairments are needed, such as assessment technologies, assistive devices, and rehabilitation techniques. Assessment technologies can play a significant role by focusing on the various chronic conditions that lead to functional impairments and the types of resources available to assist the individual. But the prevailing emphasis on medical and skilled nursing care has limited the use of assessment technologies, both in long-term care institutions and in the community. At the same time, the new Medicare prospective payment system for hospital care, based on Diagnosis Related Groups (DRGs), will encourage the earliest possible release of older patients, which increases the importance of adequate discharge planning and use of appropriate assessment technologies. Yet physicians and other health care providers generally lack training in the use of such measures, and there is disagreement about the reliability and validity of existing assessment technologies.

Assistive devices are available to compensate for some impairments in hearing, vision, walking, and other functions. Various other devices can assist the moderately impaired in preparing food, eating, performing household chores, and managing other activities of daily living. These devices range from simple and inexpensive to complex and quite expensive. In most cases their costs are not ***reimbursable*** under Medicare or Medicaid provisions; this factor can limit their use by older persons, Other factors restricting their use include lack of information about available devices, the difficulty of selecting appropriate devices for individuals with multiple impairments, and negative attitudes of elderly individuals, their families, and many health care professionals about the usefulness of the products.

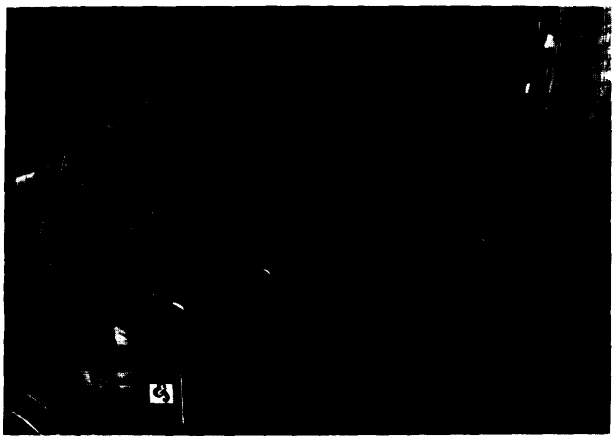


Photo credit: M. Holtby, 'Seniors' Resource Center, Jefferson County, CO
Assistive devices helped the impaired elderly to remain active.

Another growing need is the availability of rehabilitation devices and techniques for post-hospitalization care in the home. The implementation of DRGs under Medicare is likely to increase the need for medical technologies that can be used for outpatient and in-home rehabilitation. The need for new devices to assist in the rehabilitation of older persons will grow, but their cost and complexity may limit their availability. As with assistive devices, negative attitudes toward the rehabilitation potential of older persons may restrict the use of those devices that are available.

PREVALENCE OF MENTAL AND PHYSICAL IMPAIRMENT

Some elderly individuals have mental conditions that can cause functional impairment or increase their degree of physical dependency. The degree of physical and mental impairment is related to need for long-term care and the risk of institutionalization. About half of all residents of nursing homes and board and care facilities have some degree of mental confusion. But the proportions of these individuals who are functionally impaired because of mental confusion and the proportions who are impaired by ***both*** physical and mental conditions are not known. Nursing home residents are more likely to have severe mental confusion and to be highly dependent in the basic activities of bathing, eating, and toileting. Some data on nursing home residents show a high statistical association between mental confusion and degree of physical impairment, particularly in the areas of severe incontinence and inability to bathe or feed oneself. Persons with both mental and physical impairments usually require 24-hour care, which is a great burden for most caregivers.

There appears to be a ***critical threshold*** of physical and mental impairment, beyond which family caregivers can no longer effectively care for the dependent person and are usually forced to rely on institutional care. Despite the great difficulties that families and health care providers must face in caring for these highly impaired individuals, little public or private sector attention has been given to the development of devices and care techniques that might help resolve the more severe problems.

Although most patients who are severely impaired mentally and physically may require skilled nursing care, some need only 24-hour supervision and personal care services. Yet existing health care reimbursement programs encourage admittance of these persons to nursing homes rather than to less restrictive and usually less costly board and care facilities. Similarly, individuals who need personal care and supportive services at home may not receive the care they need or may receive unnecessary health care services because of Medicare and Medicaid funding regulations. Negative attitudes about the concept of custodial care, and fears about the cost of providing nonmedical long-term care services for the functionally impaired elderly, also limit the availability of these services.

USE OF AVAILABLE TECHNOLOGIES

Most long-term care services are labor-intensive, and formal and informal providers receive little training in the use of devices and techniques to facilitate caregiving. Increased development and use of these technologies could lessen the burden of caregiving, allow elderly persons to remain at home longer, and decrease staff turnover in long-term care facilities. Technologies to assist patients and caregivers are used more extensively in Europe than in the United States. Western European countries generally provide a greater range of supportive environments and residential facilities to assist impaired individuals and their caregivers.

Few ***medical*** care technologies have been used in long-term care facilities or in the home. The

recent implementation of the Medicare prospective payment system and increased emphasis on the provision of health care services at home should broaden the demand for home-based medical care technologies. This trend is expected to grow, as is demand for sophisticated medical and nursing care technologies in nursing homes. Increased use of these technologies outside the hospital will depend to a large extent on public and private reimbursement policies for costs of nursing home and home care services, and on the availability of skilled health care personnel trained to use these technologies and to teach the patient and the family to use them.

These changes will require better methods of patient assessment and increased coordination of the caregiving network to promote a continuum of care based on categories of need among different groups of patients. Efforts to improve service delivery have included techniques for coordinating services at the community level, case management systems, and organizational approaches that provide a range of services through a single local agency. Development of a more coordinated system of services could enhance the ability of some elderly individuals to remain at home and to plan effectively for their own long-term care.

SELECTED ISSUES

Because the demand for long-term care services is expected to continue its rapid growth, additional information will be required to develop and evaluate alternative approaches to caregiving for functionally impaired older persons. A fundamental need is expanded basic research on the chronic physical and mental conditions that cause impairment. Given the prevalence of existing conditions, additional research is needed for development, utilization, and evaluation of technologies to meet the needs of the long-term care population. Devices and techniques to assist older persons with multiple impairments and mental confusion need to be developed. Accordingly, more information is needed on the relationship between mental confusion and functional impairment, and on the impact their severity has on the demand for different types of long-term care. Improved methods are needed to reliably assess the extent of chronic conditions and impairments as well as the devices or techniques that can best ameliorate them.

Most of these research areas are related to other issues for congressional review regarding the growing need for long-term care. These include:

- ***Should Congress promote the expanded development and use of comprehensive assessment technologies for the community-dwelling and the institutionalized elderly?***
- ***Should Congress mandate additional funding for long-term care serices-based on degree of functional impairment-delivered in the home and in care settings other than nursing homes?***
- ***Should Congress implement policies to increase the use of assistive devices and rehabilitation technologies in the home and in other long-term care settings?***

*Health care costs **

Health care spending has been rising and will continue to do so under present policies, but the growth in numbers of those over 65–particularly those over 75—will intensify demand for acute and long-term care services. Recent data indicate that about one-third of all health care expenditures are by the elderly, and that up to 30 percent of all Medicare payments are made for care of persons in the last year of life. But the growth of the elderly population is ***not*** the main reason for the rapid escalation in health care costs, which have been increasing at almost ***three*** times the general rate of inflation during the past 5 years. Health care expenditures in 1982 totaled more than $322 billion, an increase of almost 30 percent since 1980. In 1983 total health expenditures rose an additional 10 percent and reached $335 billion-comprising more than 11 percent of the gross national product. The dramatic increases are largely due to intensification of services, expanded availability and use of costly diagnostic and treatment services and technologies, and the rising cost of labor. This excessive inflation in health care costs has led to concerted efforts to

*This issue is examined in detail in ch. 8.

contain spending, which have far-reaching implications for older Americans.

DEMAND FOR HEALTH CARE

Demand for health care by older persons is influenced by physical, psychosocial, and economic factors. The increased use of services by some older persons is usually due to their increased burden of illness. The remarkable recent decreases in mortality among those over 65 have not been accompanied by similar decreases in morbidity. Moreover, older persons tend to underreport symptoms of chronic conditions. Some studies have shown an average of three correctable problems per elderly patient; many of these problems could have been identified earlier by using functional assessment measures or by using greater care in taking the patient's history.

While most older persons are functionally independent, many require health care for chronic conditions that increase in prevalence with age. Spending for health services represents a major problem for both elderly individuals and the Federal Government. Medicare provides an important health care subsidy for those over 65, but it is by no means comprehensive—many necessary services and technologies that affect health and functional status, such as dental services, eyeglasses, and hearing aids are not reimbursable. The growing need for long-term care as age rises means that increasing proportions of the elderly population whose financial resources become depleted have to rely on public means-tested programs such as Medicaid and Supplemental Security Income for the cost of long-term care services, Private financing mechanisms such as "medigap"[17] or other types of private insurance do not provide adequate supplemental protection. The few private insurance policies that are available for long-term care, especially for nursing homes or skilled care at home, are extremely selective for participation and very expensive. Yet one-fourth of all health expenditures by the elderly are for nursing home care, of which public programs (primarily Medicaid) pay about one-half. The increases in these costs show no sign of abating, as more expensive technologies become available and the need for care grows within the aging population.

[17] Wiedigap insurance has been developed by the private sector to help patients cover the cost of medical expenses not reimbursable by Medicare.

COST-CONTAINMENT EFFORTS

Cost-containment efforts to date have not been effective in controlling overall health spending, whether by individuals, the Federal Government, or third-party payers. Most approaches have focused on hospital care and rate-setting, as in the new Medicare prospective payment system. The response of the health industry has been increased shifting of services to ambulatory settings (e.g., outpatient and rehabilitative care) or shifting costs to other Federal programs, other insurers, and consumers. Attempts to shift a greater share of costs to consumers in order to minimize overutilization of health services have tended to reduce the number of persons seeking care, but have not changed use-patterns after a diagnosis has been made. Cavitation approaches have been most successful in encouraging the substitution of lower cost services for expensive hospital care. Recent experiments are extending the cavitation concept to include supportive social services.

The coordination of services and benefits among Medicare, Medicaid, and other public programs that influence health care remains a problem in access to care for the elderly. Poor coordination can increase costs because the most appropriate services are not provided; better coordination may increase utilization and overall costs, but can also improve the quality of care and reduce the need for acute care. The incremental costs and benefits of each action must be evaluated.

As has been noted, attempts to control Medicare costs through prospective payments could affect quality of care for patients in hospitals awaiting placement in long-term care institutions. Premature discharge may result in multiple admissions and shifting costs to home care, increasing overall costs for these patients as they are cycled back and forth between inadequate community settings and the hospital.

Other reports have addressed cost-reduction questions related to changes in eligibility, benefits, and financing mechanisms for the existing Medicare program. Recent Congressional Budget Office reports explore options to increase revenues or decrease outlays as well as potential schemes to tie deductibles to income level. This assessment concentrates on the cost-containment issues in Medicare and Medicaid as they relate to the aging of the population, the demand for health services and long-term care, and changes in technology.

SELECTED ISSUES

The volatility of health care costs in recent years has spurred considerable research and evaluation at all levels of government and in the private sector, but significant gaps in knowledge remain regarding such questions as how to maintain quality and access to care while promoting cost-effectiveness and cost reductions. More information is needed on the range of factors that affect the use of health and long-term care services by the elderly. Research is needed on how to improve measures of health outcome, better strategies for educating consumers, and alternative methods for financing health care and long-term care.

Specific issues regarding health care cost-containment strategies and their effects that are likely to face Congress include:

- ***Should Congress strengthen the quality assurance mechanisms for health care services because of possible adverse effects of cost containment?***
- ***How might Congress stimulate coordination among preventive social, long-term care, and acute care services to promote efficiency and reduce costs for unnecessary types of care?***
- ***What types of function-enhancing technologies can be encouraged to reduce the need for health care services?***
- ***Should Congress act to increase coordination among Federal and State programs to avoid unintended interprogram cost-shifting?***

Social changes in the living environment

*Housing and the living environment **

The housing environment takes on greater significance as people age-especially in terms of lifestyle continuity, neighborhood familiarity, physical security and safety, and emotional sustenance. Although the older population has the highest percentage of home ownership, physical housing deficiencies and excess cost burden also tend to be higher among many subgroups of the elderly. Resolving these problems may require new and specific types of Federal assistance. Of particular concern is the growing number of very old persons who live alone, especially those who have functional impairments. For these individuals, informal supports from family and friends often mean the difference between institutionalization and continued residence in their homes. New technologies and services, when combined, could provide increased assistance for maintaining independence in the household, especially as the availability of informal support shrinks.

ELDERLY HOUSEHOLDS AND HOUSING TENURE

During the last two decades, the number of elderly households has risen proportionately more rapidly than the number of elderly persons. Changes in living arrangements, especially the growth in numbers of older persons living alone, have contributed to this trend. The proportion of U.S. households headed by an older person has increased from 15 percent in 1950 to more than one-fifth today. Marital status and living arrangements have also changed since 1960, due in large part to sex differences in life expectancy. More than ***four times*** as many older women as men live alone; more than three-fourths of older men but

● These issues are examined in detail in ch. 9.

less than two-fifths of older women are married and living with their spouse. Most recently, the proportions of older men and women who live with nonrelatives have decreased. This trend is particularly evident among women over 85, who are also far more likely to live alone or to be institutionalized.

Approximately three-fourths of all elderly households are owner-occupied, of which four-fifths are owned mortgagefree. The growth of housing ownership by the elderly has continued unabated since World War II. Since 1980, despite an increase of more than 1 million elderly households, there has been a net decrease in the number of renter-occupied elderly households. Although Federal housing programs and subsidies for the elderly have been directed at rental units for low-income persons, there is growing awareness of the particular problems of—and possible opportunities for-elderly homeowners.

HOUSING PROBLEMS AND FEDERAL PROGRAMS

Housing tenure of the elderly tends to correlate with various social and demographic characteristics related to need for assistance. Rented units are far more likely than owned units to be occupied by one person. Because single-person units among the elderly are highly likely to be occupied by women, they are also twice as likely to have households with incomes below the Federal poverty level. Renter-occupied units are also more than twice as likely to have physical and maintenance deficiencies Elderly owner-ccupied households, which also have these types of deficiencies, may also face the problem of excess housing cost burden, especially for those elderly persons on fixed incomes who still have a mortgage indebtedness.

Federal housing policies to assist the elderly have concentrated on the problems of low-income renters through major programs such as Section 8 rental subsidies, low-rent public housing, and Section 202 rental housing for the elderly. But these housing programs for the elderly have been narrowly directed toward building construction and provision of rental units, with little attention to special design features that respond to the physical and psychosocial needs of older persons. In the past, the design of some federally subsidized high-rise housing projects for the elderly increased the likelihood that the residents would become isolated, injure themselves, or be victims of crime. Also, only limited Federal efforts have been directed at preserving the housing stock or promoting rehabilitation of elderly dwelling units–either rented or owned.

Until recently, no attention was given to the coordination of housing programs with services needed by elderly residents. The need for services is growing as the older population ages and as the first cohorts of elderly tenants in public housing and Section 202 projects "age in place." A similar process is occurring in suburban neighborhoods, where the number of elderly residents is growing rapidly. These new cohorts of old and very old homeowners and renters have greater needs for assistance in transportation, household chores, dwelling maintenance, and access to community-based services. The preponderance of older persons living alone and the lack of available support from family and friends-especially for those over 75+xacerbate these problems and increase the degree of assistance needed.

HOUSING OPTIONS FOR THE ELDERLY

Federal housing programs need to recognize the heterogeneity of the older population and to induce development of a range of housing options that provide varying levels of support. Existing rental unit subsidy programs could be better integrated with congregate services and community programs for the elderly. They could also encourage housing alternatives such as shared housing. Shared housing programs provide income to older homeowners while supplying rental space at affordable prices, Other advantages of such programs are efficient utilization of excess housing space, reduction of social and physical isolation, and provision of informal supports for older persons. Intergenerational shared housing promotes interaction and assistance between generations.

Other housing options include accessory apartments or "echo" (elder cottage housing opportunity) housing. Accessory apartments are usually created within single-family residences. The house is converted to accommodate a separate apartment with little or no change in the home's

outside appearance. Preservation of neighborhood character is an important element in the acceptability of accessory apartments in most communities. Modular bathroom and kitchen units have made such conversions more efficient and less costly. Echo housing units, also called '(granny flats,)' are compact, efficiently designed, temporary structures that are erected in backyards of family homes and designed for use by elderly relatives. The standard unit is a modular three-room house of about 600 square feet.

Despite their efficiency and low cost, these housing options for the elderly face opposition in local communities that seek to preserve single-family zoning laws. These neighborhoods are the most likely sites for echo housing and accessory apartments, but are also the most likely to resist changes to the single-family nature of the neighborhood. Yet the Census Bureau estimates that there are more than 2.5 million accessory apartments in the United States. Echo housing, which cannot be concealed within an existing unit, is far less prevalent.

In addition to federally subsidized housing for the elderly, other types of congregate housing have been developed by the private sector. Life care, continuing care) and residential care communities are analogous terms for communities in which older persons pay a large entrance fee and a monthly service fee to live in a unit within a complex that typically provides supportive and health care for the remainder of the person's life. There are more than 100,000 elderly residents in ***300*** such complexes in the United States, some of which have already experienced financial trouble. Financing problems usually arise because of unsold units, lack of initial capital, and underestimates of actuarial cost factors for providing Lifetime care to the residents. Fewer than 15 States have laws governing the operation of life care communities and no Federal protections exist. Some of the newest housing developments provide residential care, but do not offer lifetime care contracts to prospective residents.

other supportive environments include board and care homes that range in size and type. Some have only a few residents and others are large residential care facilities. They also differ in the types of residents they accommodate and the types of supportive services they provide, with some caring for mentally impaired and frail individuals, many of them elderly. Most board and care homes are State-licensed and a majority of their residents receive public income maintenance subsidies. More information is needed about the range of facilities that exist and the types of residents they can accommodate. It appears that some persons who are in need of long-term care can be well served in such facilities rather than in more costly nursing homes.

IN-HOME TECHNOLOGIES

Many possibilities exist for applications of technologies in the home to assist older persons in maintaining independence and adapting the environment to meet their needs. These technologies, in conjunction with appropriate design of the dwelling unit, can enhance the older person's "environmental fit" and competence, both of which enable him to control his environment. New, relatively inexpensive technologies allow housing to be readily adapted for the impaired or retrofitted with improved safety and communication features. Low technologies include simple ones that promote mobility, such as safety treads on stairs and in bathtubs, handrails and grab bars, and ramps. Many simple technologies can mitigate the common problems of reduced vision and decreased grip strength in the elderly—including door handles in place of door knobs, special controls for major appliances, jar openers, adaptive utensils, and other household gadgets. Various dressing, bathing, and grooming aids are available to compensate for the impaired person's decreased tactile ability and lessened agility, particularly from arthritis. Zipper pulls, "velcro" fasteners, and hand-held shower sprayers are a few examples.

High technologies are more complex and have widespread applications in the home. Especially helpful are communications technologies, such as automatic alarm and telephone dialing systems for emergency help (including electronic monitors that detect falls or injuries), portable telephones, and other security devices. Electronic safety systems are available to "program" appliances to shut

Photo *credt: Roger* **Austin, Peterborough Development Corp.**

Supportive housing environments can promote the independence of elderly residents.

off after predetermined lengths of time or to monitor and control heat, air-conditioning, and lighting. In-home computers can provide various self-instruction programs for medication, nutrition, and other self -care assistance. They can also provide "catalogs" of products for in-home comparison shopping. Modems for personal computers will enable older persons to communicate for a wide range of purposes, such as banking and bill-paying from the home; some health monitoring can be accomplished with interactive computers. Interactive television and "videotex" telecommunications allow individuals to compare, select, and purchase a wide range of goods and services without leaving the home.

OTHER HOUSING OPPORTUNITIES

New financing instruments provide other possibilities for enhancing the older person's housing options. New equity-based financing instru= ments can help some elderly homeowners increase their income and remain in their homes. Reverse mortgages typically allow elderly homeowners to convert up to 80 percent of their home equity into monthly income for a specified period of years. The homeowner retains ownership, but reduces his equity in the home over time. As currently offered, most reverse mortgages require repayment of the full loan amount (the total of disbursed monthly payments plus accumulated interest) at the end of the loan period (usually 5 to 12 years), New instruments may soon be marketed that will not include the payback requirement at the end of the loan period, but still allow the older person to remain in the house.

A second type of home equity conversion is the sale-leaseback plan, in which the older homeowner sells his house to an investor in return for the right to lease back the house for the rest of his life. The typical sale-leaseback plan includes a downpayment to the elderly seller, who carries an interest-bearing note for the balance of the purchase price, paid in monthly installments over a period of years related to the seller's life expect-

ancy. Advantages to the seller are the right to remain in one's home for the rest of one's life, to pay a fair rental, to receive full price for sale of the house, and to earn interest on the note. The buyer's advantages include depreciation of the rental property, income tax deductions, and any appreciation in the house's value over time. Either of these procedures for home equity conversion requires consumer protections and counseling for the parties involved.

SELECTED ISSUES

The range of housing problems and options for the elderly is expected to grow because of the increasing number of homeowners and the heterogeneity of the older population. Research into these options should include more extensive analyses of shared housing, accessory and echo housing, board and care homes, and life care communities. Too little is known about each of these options, the types of consumer safeguards that may be required, and the potential role of the Federal Government in promoting their availability for the elderly. Home equity conversion plans require greater review and the opportunity to develop new instruments in response to consumer demand and requirements for consumer protection. The range of in-house technologies should be evaluated by appropriate Federal agencies for safety and efficacy.

This research can be supported by direct Federal involvement or by incentives to the private sector, especially the housing and finance industries. The growing involvement of the private sector in development of retirement and life care communities, in manufacture of modular housing, and in the production and marketing of hundreds of in-home devices attests to this potential.

The following questions suggest areas for possible congressional consideration:

- ***Should the Federal Government expand existingpqgrams that assist low-income elderly homeowners who have housing deficiencies and excessive cost burdens?***
- ***How might Congress encourage utilization of technologies that promote the independence of older persons who are either slightly impaired or restricted in managing major activities in the home?***
- ***Should Congress provide support for public and private sector efforts to develop new housing construction and desi~ technologies that assist older persons in the home?***
- ***Should Congress promote the expansion of public and private housing alternatives for older Americans?***

Work-related changes

*workplace technology and the employment of older adults**

The structure of the American economy has undergone major changes since the mid-1800s, when it was agriculturally based and farm workers constituted two-thirds of the labor force. The United States had become an industrial nation by the 1920s, when more than two-fifths of all jobs were in manufacturing industries and only about 1 in 10 workers remained in farming. During the 20th century the mechanization of farming and the automation of manufacturing have ushered in a new economic era increasingly characterized by service sector occupations. only 3 percent of today's labor force is employed in on-farm agriculture, while 23 percent are in manufacturing, and more than 60 percent are in the service and trade sectors. These changes are expected to continue as the economy becomes increasingly dominated by the electronics revolution and the service sector jobs it creates.

TRENDS IN LABOR FORCE PARTICIPATION OF THE ELDERLY

These trends have been accompanied by the aging of the U.S. population and a marked decline in the labor force participation rate of persons

* These issues are examined in detail in ch. 10.

over ss. Workers now 4s and over may be particularly vulnerable to the latest changes in the work force. Older workers are primarily located in industries and occupations that were growing when they entered the labor market; many older workers are employed in manufacturing, which expanded in growth through the 1940s. Manufacturing and related industries-and their share of the labor force—began to decline in importance during the 1950s, by which time the earlier young cohorts of workers in these industries were '(aging in place."

The explosion of workplace technologies during the last two decades has threatened the previously secure future of these older workers. Although there is no direct evidence that significant numbers of older workers have been displaced by workplace technologies (e.g., union seniority rules in many manufacturing trades tend to protect older workers from unemployment), there is concern that future cohorts of older workers—those who are now aged 35 to 45—will face such possibilities. Recent advances in medical technologies, computers, and robotics[18] have led to the development of new occupations in a variety of high-technology medical care services and in computer programming, operation, and repair–jobs from which workers over 45 are likely to be excluded due to lack of appropriate skills. To remain employed, some older workers may need to accept low-skilled, low-paying jobs, or receive extensive on-the-job training. The likelihood that unemployed older workers will find employment at their previous pay level is expected to be significantly diminished.

EFFECTS OF TECHNOLOGY IN THE WORKPLACE

It is becoming increasingly likely that the pace of technological change in the workplace will present problems for older workers of the 1990s and the turn of the 21st century unless they are trained for positions in the growth sectors of the labor force. Although projections vary, one set indicates that by the year 2000 employment in service occupations will comprise about 85 percent of all jobs. Jobs in manufacturing will have declined to about 11 percent of the total. Meanwhile, as technologies evolve, many jobs in declining industries are either being replaced by automation or disappearing. Jobs in the manufacturing, farming, and private household service sectors, which have high proportions of older workers, are declining most rapidly.

Technology may adversely affect older workers' potential to keep these jobs, but it is also likely to improve working conditions, promote safety, and expand opportunities for other workers over 45. Technology is creating new jobs in many industries that currently have high proportions of older workers who can be retrained for these positions (e.g., steel factory floor foremen have been trained to operate computerized control centers instead of supervising "from the floor"). New service industry jobs and more clerical jobs may offer security to some older workers whose skills will remain in demand. And the possibility of doing today's jobs in tomorrow's '(electronic cottage)' (the computer-based office at home) may provide opportunities for older workers who want to work on a part-time or flex-time basis and/or obviate daily travel to work (clerk typists and stockbrokers, for example). Nevertheless, older workers will need to compete with younger workers who may seek similar flexibility in their job structures. The continuing influx of women into the labor force will intensify this competition.

Technology can benefit older workers who have physical impairments. Assistive devices, computers, robots, and other workplace technologies can compensate for waning physical strength, dexterity, eyesight, or hearing and can help improve employment prospects for those not ready for retirement. Workers of all ages can be protected by technologies that replace physically hazardous jobs or those involving dangerous chemicals and materials. There is evidence of long-term health hazards from certain dangerous jobs—hazards that are usually manifested in chronic conditions later in life. These health conditions are cited as reasons for early retirement by a significant number of older retirees. Replacing these jobs and providing opportunities for other work are likely to help older workers who choose to remain in the labor force.

18There are an estimated 7,000 industrial robots now In use in the United States. Some 200,000 are projected to be in place in all types of industries and work settings by 1990; this figure may reach 1 million by 2000.

RETRAINING OF OLDER WORKERS

Retraining of adult workers will grow in importance as changes occur in the nature of jobs and the composition of the labor force. Few training or retraining opportunities are currently available to older workers, especially those with little education and in low-skilled occupations. This situation is likely to change as the population ages and fewer young workers are available for the work force. Indeed, the demographic trend toward greater proportions of older workers may coincide nicely with the projected creation of new jobs in geriatric occupations, such as geriatric service counselors and health rehabilitation technicians. Other projections indicate that the aging of the population, combined with the higher educational levels of future older populations, will increase retraining opportunities and the prevalence of second and third careers in a person's lifetime. Retraining could then be far more common and a repeated element in the lives of most workers, regardless of age.

other types of technological changes will influence the number of persons who choose to retire into a healthy and economically secure future. Current changes in the workplace, in pension planning opportunities, in health promotion, in the home, and in the management of chronic conditions later in life may support a continued trend toward early retirement. In 1983, 17 percent of men over ***65*** were still in the labor force, compared with almost 50 percent in 1950; for women in that age group, the change was from 10 percent in 1950 to 8 percent in 1983 (less dramatic reductions occurred for men *over 55,* but an in***crease*** from 27 to 42 percent occurred for women aged 55 to 64 during the same period). If these retirement trends continue and life expectancy improvements accelerate as in the recent past, the falling ratio of workers to retirees will place ever-greater pressures on the Social Security system.

In sum, technology can both hinder and enhance the ability of the older worker to continue working. Although present circumstances do not warrant immediate large-scale concern, the future growth of technology and its effects on workers will need scrutiny by policymakers to improve the quality of worklife and provide job security for aduh workers who wish to remain in the labor force as long as possible. Adequate income maintenance must also be targeted for congressional oversight, on the assumption that retirement patterns, whether voluntary or involuntary, will continue at their current level.

SELECTED ISSUES

As is the case with medical advances, accelerating technological change is most evident in the workplace. Although projections abound regarding the changing nature of the occupational structure during the next 15 years, there is very little accurate information available on either current or potential impacts on older workers. Moreover, little information exists on whether older workers are, in fact, displaced by technology or whether certain technologies instead enhance their employment opportunities. More research is needed on the functional capabilities of older workers and the precise reasons for the retirement decision. Informed policy will require specific data on the relationship between older workers' attitudes and their actual employment behavior, including the role of factors such as flex-time and part-time work opportunities, possibilities for retraining, amount of retirement income expected, social characteristics, and technological applications in the work environment (i.e., the workplace or the home).

The foIIowing questions reflect some of the immediate concerns that arise for congressional review about technological impacts on older workers:

- ***Should Congress encourage the use of assistive devices and electronic technologies in the workplace to enable older workers with physical limitations who wish to remain in the work force to do so?***
- ***Should Congress devote Federal resources and provide incentives to the private sector to retrain older workers for needed skills?***
- ***How might Congress respond to the desires of some older retired persons for alternative work options such as flex-time, part-time, and electronic cottage employment opportunities?***

Conclusion

This review of the relationship between technology and aging has stressed the importance of functional ability and the vitality of older Americans for maintaining their independence, maximizing their options, and improving their quality of life. The ongoing aging of the U.S. population is likely to increase the demand for long-term care and the need for increased assistance as the growing proportion of those over 75 face a combination of incapacitating and largely unavoidable infirmities. Some existing technologies can mitigate these problems and others may arise to prevent or delay their onset.

Technology has also been the major factor in the growth of the older population and its increased longevity. The mortality rates of all elderly subgroups have entered a new era of accelerated improvement, indicating even greater gains in numbers than had been anticipated. Technology can respond to these trends by providing knowledge and ways to apply that knowledge in the workplace, the home, the health care setting, and the community to enhance the well-being of the elderly. At the same time, the swift pace of technological change poses new challenges to society in responding to the effects of such change. Among the challenges are:

- continual adaptation and retraining for new skills in the workplace;
- providing home environments that promote functional independence;
- encouraging greater involvement of individuals in their own health maintenance;
- assuring that those in need of assistance and supportive services are appropriately served; and
- utilizing the many resources of older Americans.

It is clear that a major challenge into the 21st century will be the maintenance of the health and functional ability of the older population, particularly as the proportions in the oldest ages rise to unprecedented levels. In so doing, society will share the countless benefits that a healthy and vital older population can contribute.