

PREFACE

The past century heralded a significant shift in the age composition of the world's population. Both as a nation and a world community, we are aging. Currently, older Americans (age 65 years and over) constitute approximately 13% of the population and this group is its fastest growing segment. As the "Baby Boom" generation ages, the role of the gerontologist and other practitioners caring for the elderly will become increasingly important. The demand for clinicians to become proficient in elder care is great. Issues unique to the elderly span the gamut, from the medical challenges they must meet to the vast life experience they contribute to society, their loved ones, and their caregivers. Older adults, often having "weathered many storms," merit the highest level of deference and care in the clinical setting. The challenge for caregivers is to consistently show respect and caring for their elderly patients while dealing with complex clinical, technical, economic, social, and ethical issues. Perhaps what is most alarming is that despite the vast number of older individuals with cardiovascular disease and the complexity involved in providing their care, providers often do so in the absence of any data to guide their treatment strategies. Indeed, a review of all clinical research articles in four premier medical journals determined that less than 50% had enough elderly participants to enable any conclusions to be drawn from these studies concerning older patients themselves (1). With this in mind, we have collaborated with experts in various clinical fields to bring you this textbook. The primary purpose of *Aging, Heart Disease, and Its Management: Facts and Controversies* is to highlight what is presently known and not known in the arena of cardiovascular medicine and cardiac surgery as it pertains to the elderly patient.

The text is organized into four sections, which are described in greater detail below. Section I delineates the epidemiologic and demographic imperative that we face in caring for the rising tide of elderly individuals with cardiovascular disease and specifically highlights health care policy issues that arise. Section II provides the practitioner with several chapters covering fundamental concerns outside of the cardiovascular domain that are essential in providing care for the elderly subject, including nutritional, neurological, pharmacologic, psychiatric, ethical, and rehabilitative issues. Section III, after delineating age-related changes in cardiovascular structure and function as well as the role for risk factor modification, goes on to highlight cardiovascular syndromes that disproportionately afflict the older individual including arrhythmias (particularly atrial fibrillation), syncope, heart failure (particularly diastolic heart failure), and ischemic heart disease. Finally, in Section IV, the surgical management of the elderly cardiac patient is delineated including postoperative management and complications as well as specific surgical procedures such as coronary artery bypass grafting, valve surgery, pacemaker, and defibrillators as well as surgical management of heart failure.

PRINCIPLES OF AGING

Aging is an inevitable process common to all species. The physiologic changes that accompany aging form a natural part of the maturation process. As the numbers of elderly individuals continue to rise at staggering rates, continued study of biological, clinical,

sociological, ethical, and economic factors is essential to accommodate our elders and improve our systems of care for them and the ensuing generations.

Several important principles of geriatrics have been delineated and are an essential backdrop for this text. First, as individuals age they become more dissimilar. Thus, attributing age-related changes to a particular patient's clinical syndrome should be accompanied by a healthy amount of skepticism. Second, an abrupt decline in any system or function is always caused by disease and not by "normal aging." Though many providers and even patients will attribute their symptoms or conditions to "getting old," a practitioner well versed in the principles of geriatric medicine will often find a precipitating pathophysiologic condition. Third, "normal" aging can be attenuated by modification of risk factors. Thus, many of the proposals for a healthy lifestyle, such as exercise, a well-balanced diet, and avoidance of tobacco products, are equally important in attenuating the ill effects of aging. Finally, "healthy old age" is not an oxymoron. It is quite possible for people to live healthy, active, productive lives well into their eighties and nineties.

BASIC TENETS OF GERIATRIC MEDICINE

The basic tenets of geriatric medicine that have been described to reflect the fundamentals of geriatric care offer the clinician both a set of "cardinal" rules and a practical guideline for the management of elderly patients. In the reading of various chapters, we encourage the reader to keep these principles in mind.

Tenets of Geriatric Medicine

- The onset of new disease in the elderly generally affects an organ system made vulnerable by physiologic and pathologic changes.
- Because of an impaired physiologic reserve, older patients often present at an earlier stage of their disease.
- Since many homeostatic mechanisms may be compromised concurrently, there are usually multiple abnormalities amenable to treatment, and small improvements in each may yield dramatic benefits overall.
- Many findings that are abnormal in younger patients are relatively common in older patients. They may not be responsible for a particular symptom but only be incidental findings that result in misdiagnosis or misdirected therapy.
- Since symptoms in older people are often due to multiple causes, the diagnostic "law of parsimony" often does not apply.
- Because the older patient is more likely to suffer the adverse consequences of disease, treatment (and even prevention) may be equally or more effective than in younger patients.

REVIEW OF HUMAN AGING

From a physiologic standpoint, aging can be described as the progressive decline in homeostatic reserve (homeostenosis) of every organ system. As humans age a number of physiologic changes occur that are related to senescence and many of the aging theories. Essentially, each and every organ system becomes modified to some degree, though the aging process is selective. Generally speaking, these modifications occur in the negative direction, reflecting loss of organ reserve capacity. Notably, there is considerable overlap between physiologic changes and pathophysiologic processes. Often, one or more organ systems will fail secondary to some pathophysiologic mechanism, and the remaining

healthy yet senescent components of the body may respond inadequately to other insults. In this sense the organs' interdependence upon one another is truly illustrative.

The aging human organism undergoes a series of general and organ-specific changes. The overall body composition changes, manifest by a loss of lean body mass and a decrease in total body water. Body fat is subsequently redistributed. Various organs are also affected. The cardiovascular system experiences vascular calcification and increased stiffness, as well as reduced vessel compliance. Pulmonary changes include a decrease in vital capacity, chest wall strength, and forced expiratory volume per one second (FEV1), resulting clinically in an increased work of breathing, diminished pulmonary reserve, decreased effective cough needed to clear secretions and microbes, and overall chronic obstruction. In the aged kidney, total nephron mass is decreased, renal blood flow is slowed, creatinine clearance is diminished, and the ability to concentrate urine is decreased. Clinically, elderly individuals are prone to dehydration and experience reduced clearance rates of drugs and drug metabolites. This latter feature is partially responsible for the sensitivity of this subpopulation to drug therapy. There are high rates of drug interaction and increased likelihood of toxicity and organ damage secondary to drug intake and the potential side effects from drug interactions. The elderly immune system demonstrates decreased T-cell function and decreased antibody production, leaving individuals more susceptible to infectious illness. As humans age, progressive bone loss, particularly in postmenopausal females, ensues. This leads to brittleness of bones and an increased risk of hip fracture and its associated morbidity. The gastrointestinal tracts of aged individuals also experience changes, including gastric atrophy as well as decreased gastrin activity and parietal cell secretion of hydrochloric acid. There is a high incidence of dysphagia among the elderly as well, a clinical syndrome leading to morbidity secondary to aspiration of gastric contents. Integumentary changes include thinning of the skin with a reduction of subcutaneous fat. Thinning of the skin often puts older adults at risk for developing decubitus ulcers, or bed sores, resulting in marked discomfort and associated morbidity. Additionally, these people become intolerant to colder temperatures, manifesting increased susceptibility to experiencing hypothermia, particularly when undergoing cardiopulmonary bypass. Individuals commonly experience neuropsychiatric and neurocognitive changes as they age. Cortical atrophy is prominent. Nerve conduction velocity declines. The incidence of Alzheimer's disease in the elderly is notably high. Figure 1 demonstrates declining organ function with age.

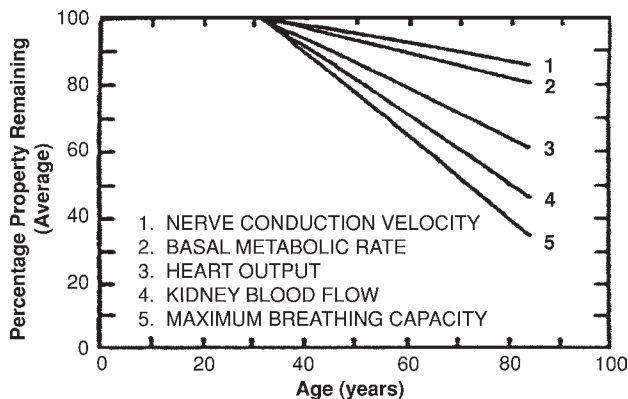


Fig. 1. Linear decline of organ function with age (1).

IMPACT OF AGE ON CARDIAC SURGERY AND CARDIAC DISEASE

In the setting of an intensive care unit or under perioperative circumstances, advanced age often translates into high risk. Elderly individuals have altered drug excretion caused by their 25% decrease in renal mass and decline in renal blood flow. Often surgery increases the risk of renal failure. For example, cross-clamping and cardiopulmonary bypass cause a reduction in blood flow, further compromising renal perfusion pressure. Accumulation of certain drug products, particularly anesthetic agents and opioids, results in prolonged intubation time. Weaning an elderly patient off of a ventilator becomes increasingly difficult with multisystem decompensation (2). Patients undergoing cardiac surgery are typically instrumented with a transesophageal echocardiogram (TEE) probe. Advanced age and TEE instrumentation increase an elderly person's risk for developing dysphagia. In turn, the risk of aspiration pneumonia increases, creating a complex picture of co-morbidity. Since human organ systems are intrinsically connected, damage to one system invariably affects other systems, particularly in an elderly individual whose organ reserve capacity is diminished.

These various alterations in cardiac function in the older individual often create the need for polypharmacy and potentially multiple interventions. For example, a person with hypertension, atherosclerosis, and an arrhythmia will require treatment with a series of pharmaceutical agents. Often, employing one medication to treat a single disease creates the need to use another medication to counterbalance the effect of the first drug. For example, a hypertensive elderly patient placed on beta-blockers who has intrinsic conduction defects may experience symptomatic bradycardia, necessitating the placement of a pacemaker. Dealing with older individuals often creates complex scenarios. Our hope is that after reading this text, providers will be better able to tackle the multitude of issues they and their patients face.

EPIDEMIOLOGY, DEMOGRAPHICS, AND HEALTH CARE POLICY

Americans are living longer, healthier, more active lives than ever before. Longevity has increased by 28 years since 1900, and recent studies indicate that many older citizens have fewer disabilities today than people the same age had just 15 years ago. Nevertheless, older Americans who do require medical attention tend to have multiple and complicated problems. The ever-increasing population of older patients who have cardiovascular disease parallels the demographic imperative that is changing the face of the world's population. Last year, 6,145,000 patients discharged with cardiovascular disease were over the age of 65 years. This same age group contributed to eighty-five percent of all myocardial infarction deaths. Fifty-six percent of coronary artery bypass graft (CABG) patients and 51% of the percutaneous transluminal coronary angioplasty (PTCA) procedures were performed in individuals over 65. The numbers of elderly patients comprising the cardiac patient population are staggering.

Section I of the text provides the backdrop for the rest of the text. In Chapter 1, the demography and epidemiologic data are described drawing attention to the crisis looming in health care. Subsequently, Drs. Ridge and Cassell describe the history of health care policy specifically as it pertains to the elderly in the United States in Chapter 2.

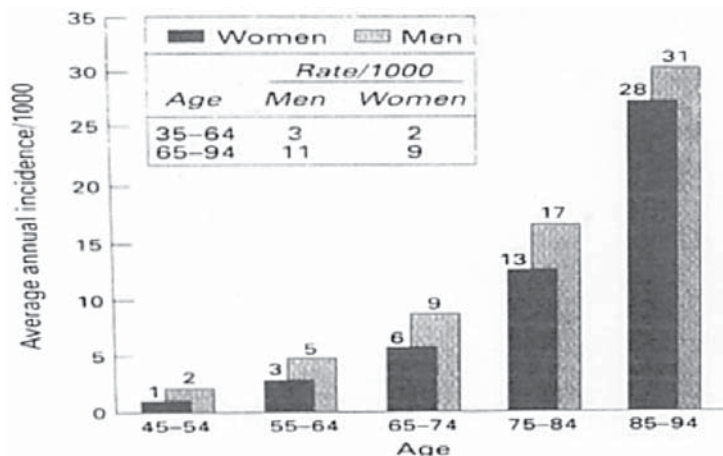


Fig. 2. Increasing incidence of heart failure in the aging population (3).

FUNDAMENTALS OF CARE FOR THE ELDERLY

Caring for the elderly patient with cardiovascular disease requires a multidisciplinary approach. Therefore, in this section of the text, we have asked our contributing authors to delineate age-related changes in organ systems outside of the cardiovascular system and how they impact on the manifestations and management of the cardiovascular disease in the elderly. Drs. Elkind, Kenny, Muskin, and Shapiro as well as Dr. Chong and colleagues provide valuable information regarding neurologic, psychiatric, and nutritional issues, respectively. Subsequently, Dr. King provides insights into the process of rehabilitation, an essential step in improving the quality of life in the elderly subject with cardiovascular disease who has undergone cardiac surgery. As our pharmacopoeia enlarges and the benefits of various agents are realized, concerns regarding the appropriate use of pharmacologic agents are of paramount importance in the elderly as described by Drs. Odeh-Ramadan and Remington. Finally, with all of the ethical issues that surround the care of our older patients, we would be remiss without considering carefully the concerns presented by Dr. Prager in his chapter on ethical issues.

CARDIOVASCULAR CARE FOR THE ELDERLY

Changes in cardiovascular structure and function are selective, with some portions of the cardiovascular system affected dramatically even as others are well maintained during normal human aging. In this section of the text, Drs. Maurer and Weisfeldt delineate these normative age-related changes and place them in clinical context. Subsequently, Dr. Wenger emphasizes the role of preventive strategies that can attenuate many of the disorders that disproportionately afflict the elderly. Finally, Drs. Reiffel, Bloomfield, Kitzman, Zieman, Schulman, and Fleg provide a comprehensive evaluation of the current facts and controversies that surround the management of dominant geriatric cardiovascular syndromes: atrial fibrillation, syncope, heart failure, and ischemic heart disease, respectively.

CARDIAC SURGICAL CARE FOR THE ELDERLY

A crucial aspect of surgical management of the elderly is the ability to make the right decision when one is faced with a multitude of imperfect options. The decision to operate should not be based on age alone, but reflect an assessment of the risk–benefit ratio of individual cases. Though it has been demonstrated that cardiovascular reserve capacity decreases with aging, chronological age alone should not be relied upon as a predictor of outcome. Instead, more emphasis should be placed on the functional status of the patient. In the earlier days of cardiac surgery, advanced age was considered a relative contraindication for revascularization procedures. However, as surgical techniques and perioperative management have improved, more elderly patients are now accepted for surgical intervention.

With an increasingly aging population, surgeons can expect a greater proportion of their workload to include patients aged over 75 years. During the 1990s we performed cardiac surgical procedures on 1448 subjects 75 years of age and older at our institution. This represented more than 10% of all cardiac surgical procedures. The number of patients over 75 years old presenting to a cardiac surgeon in our institution has increased over the past five years resulting in the initiation of the AGE (American Geriatric Experience) Program. This program is designed to foster clinical care, research, and education in the arena of cardiovascular disease in the elderly.

Our contributing authors in this section define the issues essential to providing cutting-edge surgical management of the elderly cardiac patient. Drs. Garrido, Argenziano, and Rose describe the surgical management of ischemic heart disease, while Drs. Oz and Smith cover the surgical management of heart failure and valvular disorders, respectively. Inasmuch as indications for pacemakers and defibrillators have expanded, Dr. Spotnitz provides a practical guide regarding the application of these technologies to the older individual. Finally, Dr. Edwards delineates the outcomes, both positive and negative, that accompany the expansion of cardiac surgical procedures for the elderly, and Dr. Playford provides instructions regarding postoperative management.

CLOSING THOUGHTS

You will find throughout your reading of the various chapters of *Aging, Heart Disease, and Its Management: Facts and Controversies* that there are perhaps far more “controversies” than “facts.” This leads us to our second purpose, namely, to delineate the present issues that require immediate attention by the clinical and research community in order to improve the quality of care that we provide to our older patients with cardiovascular disease. To that end, we hope our book will serve as a simple step in the right direction.

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The Evolution of the American Health Care System

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INTRODUCTION

The common perception of medicine in America is that we have and will continue to have the best health care in the world—the best doctors, the best hospitals, the best technology, and, likewise, every American citizen is entitled access to the best medical care. Every disease is potentially curable, and everything that can be done for a sick person must be done. In essence, where health care is concerned, there are no limits. Increasingly, however, we are confronting the fact that there are indeed limits, particularly in our ability to provide continued and equitable access to the “miracles of modern medicine.”

Historically, the American health care system has operated as a “fee-for-service” enterprise. In such a system patients freely chose their providers, and along with those providers, they made all medical decisions knowing that the costs incurred were theirs to pay. Cost controls were automatic in this system, and rationing was self-imposed. For much of the nation’s history, this system worked well. Doctors had little to offer in terms of effective (and expensive) therapy and patients’ expectations were generally low—a critical balance.

This equilibrium began to falter by the first half of the 20th century. During the Great Depression, hospitals began to suffer from the patients’ inability to pay their bills, and it was the financially stressed hospitals that prompted state legislatures to implement the insurance schemes that became known as Blue Cross.

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To assuage the indignation of physicians, the Blues were created as non-profit, provider-oriented insurance organizations. They did not attempt to tell physicians how to practice medicine. Physicians did what they deemed necessary, and the Blues paid the bills on a traditional fee-for-service basis. Not only did the system preserve the direct relationship between the physician and the patient, but it also paid the bills more reliably than the patients themselves. Because this system seemed flawless, there were no objections to the rather rapid formation of private health insurance companies as long as they mirrored the structure the Blues had put into place (1).

The economic restructuring prompted by the Second World War brought about the next major change in the US health care system. During the wage and price controls of World War II, companies capitalized on the popularity of insurance and began offering health coverage to their employees in lieu of higher wages. By the time the war ended, this “benefit” was rapidly transforming into an “entitlement,” and American labor unions began to demand that employers provide health insurance. The government encouraged the provision with lucrative tax cuts to the employers. In a short time, the majority of American workers enjoyed employer-provided health care insurance heavily subsidized by the federal government. This new tax policy represented a seminal event in the evolution of health policy. It shifted the fiscal burden of health insurance away from the consumer (and the employer) to the government.

In the 1960s, the federal government became more directly involved in supporting the nation’s health care system first with the institution of Medicare and, shortly after, the Medicaid program. Prior to 1966, less than half of all elderly persons in the United States had any health insurance. For those with chronic health conditions, 70% had no insurance. With the rising costs of the time, for many elderly individuals, a hospital stay could eliminate the results of a lifetime of saving. In 1965, Congress enacted Medicare as a social health insurance program for the elderly; that is, everyone would contribute premiums while they worked and would, in turn, receive benefits when they retired, regardless of income or health history. At the time, Medicare was envisioned by many as the first stage in universalizing healthcare in the United States.

The advent of these programs, along with the tax incentives provided to employers who offered health care benefits, ushered in the “golden era” of American medicine in the second half of the 20th century. The system seemed nearly perfect. Patients had complete freedom of choice; physician decision making remained free from outside influences, and all the while, someone else was footing the bill. The result of this economic arrangement was a complete dissociation between the consumption of health care and the responsibility of paying for it. Because of the “no-limits” attitude of the system and the ability of modern society to continually provide newer, better (more expensive) therapies and interventions, the arrangement was destined to implode. The more we got, the more we wanted. The more we wanted, certainly someone was going to find a way to provide it creating an ever-intensifying positive feedback loop. It was inevitable that those paying for the escalating costs of health care (namely government and employers) would eventually reach a monetary breaking point.

During the 1950s and 1960s, the cost of hospital care nearly doubled, and as billings rose, there were increased complaints that the traditional fee-for-service method of payment was being abused. Increasingly, corporations began to integrate the hospital system (previously a decentralized structure) and many other health-related businesses, as well as consolidate control, driving a shift toward the privatization and corporatization of health

care. Despite its new prominence as a media catchphrase, “managed care” is not a new concept; in fact, American companies, notably railroad and lumber, pioneered the contracting of medical services in the late 19th century. President Richard Nixon renamed prepaid group health care plans and coined the term “health maintenance organization” (HMO).

Managed care has long been a topic of discussion in academic circles frequented by health care policy experts and economists. In the latter part of the 20th century, the economically unsustainable system of health care delivery and payment that had developed encouraged the move from the classroom to the boardroom. In simplest terms, managed care aims to confer organization and accountability with the dual goal of providing adequate health care while eliminating waste and inefficiency. For the purpose of semantics, a HMO is the bureaucratic entity that applies the principles of managed care to a specific patient population. Despite the frequent association of the word “bureaucracy” with unnecessary complexity, the idea behind a HMO is simple: standardization.

The standardization of any industrial process leads to higher quality and lower cost. The health care industry, traditionally individualized and variable, should have been rife with opportunities to improve the process of delivery and do so more economically. In 1983, the federal government passed legislation that would pay the hospital’s portion of Medicare patient bills based on a set fee determined by one of 467 diagnosis-related groups (DRGs). This legislation marked a major turning point in the financing of medical care. Prior to this, the government paid whatever price was billed. Many private insurers followed suit. However, there are limitations to the use of industrial management principles in medicine. In actuality, few medical processes are suitable for standardization, because they lack reproducible tasks that standardization seeks to maximize. For instance, consider the treatment pathway for congestive heart failure (CHF). CHF could be caused by coronary artery disease, valvular heart disease, or a viral infection. There are four different classes of severity of CHF and the condition can be manifest in several other organ systems. Simply knowing that a patient has CHF tells you very little about what type of treatment the patient will require. The patient could require a heart transplant or just a couple of diuretic tablets. As a result of this complexity, devising critical pathways for this and many medical illnesses has proven to be very problematic.

Attempts to make the health care industry conform to the principles of the free market have precipitated most of the problems we face with the health care system currently. The promise of greater efficiency and integration of preventative health practices are inadequately powered to overcome the strength of the bottom line, and the system that took the good part of a century to mature has devolved into one in which “cherry-picking” of patients and micromanagement of physicians are the methods employed in the avoidance of cost (2).

WHO PAYS?

Of the 1.4 trillion dollars spent on health care last year, a majority was spent on the care of patients 65 yr old and older. Approximately 10.5% of an elderly individual’s household income is devoted to health care expenses, compared to 3.5% for the nonelderly (3). This proportion would be much larger were the elderly not heavily insured against health care costs. Over 95% of all Americans older than 65 are covered by Medicare. Today, Medicare pays for approx 45% of the medical expenses of the elderly. To pay for services not covered by Medicare and the deductibles and copayments associated with Medicare some individuals buy gap insurance in the private sector. Most individuals (70%) have both

Medicare and some other kind of private health insurance. Smaller but significant fractions have Medicare only (17%) or both Medicare and Medicaid (10%). Sadly, 3% of America's elderly lack any coverage at all (4).

In most cases, eligibility for Medicare begins at 65 or if one has a disability (have been receiving SSI disability income for at least 24 mo or has end-stage renal disease), regardless of income. If one is eligible for Social Security (SS) retirement benefits, one can still receive Medicare benefits regardless of age. Citizens and permanent legal aliens are also eligible for Medicare if they have lived in the United States continuously for 5 yr or more immediately preceding entitlement, or if they are 65 or older and are not eligible for other Social Security benefits. However, they generally must pay Part A premiums.

Medicare is divided into two parts: Part A and Part B. Medicare Part A covers inpatient hospital, skilled nursing facility, home health, and hospice services. Medicare Part B covers almost all reasonable and necessary medical services, including physicians' services, outpatient hospital care, durable medical equipment, laboratory tests, X-rays, therapy, mental health, and ambulance services. Medicare does not cover most preventive care, dental services, custodial or long-term nursing home care, or experimental procedures. It also does not pay for most prescription drugs.

There is no premium for Part A if you have worked more than 40 quarters (10 yr). The cost of Part B is currently around \$50 per month deducted from the SS check and a \$100 yearly deductible. Doctors do not have to treat Medicare patients, but if they do, they are legally bound to file claims with Medicare and to charge no more than state and federal law permits. Medicare will then pay the doctor 80% of the approved amount and the patient is responsible for the remaining 20%.

More than 80% of seniors have Original Medicare. Medicare supplemental insurance ("Medigap") can be purchased to fill gaps in Original Medicare coverage. Medigap insurance is specifically designed to supplement Medicare's benefits by paying some of the amount that Medicare does not pay for covered services and may pay for certain services not covered by Medicare. There are 10 (A–J) Medigap plans, with Plan J providing the most comprehensive (and most costly) coverage. Medicare can also be aligned with private companies in the form of Health Maintenance Organizations, Preferred Provider Organizations, Provider-Sponsored Organizations, Private Fee-for-Service Plans, and Medical Savings Account Plans. Poor seniors, those with monthly incomes less than \$600 and assets less than \$3600 may also be eligible for Medicaid, which fills many gaps in Medicare coverage and offers first-dollar coverage (the patient pays no out-of-pocket costs).

In the 1990s, additions were made to the Medicaid program relating to eligibility. Two new categories of recipients, Qualified Medicare Beneficiaries (QMB) and Specified Low Income Medicare Beneficiaries (SLMB), were created. The income and asset limits to qualify under these programs were less strict than the limits under existing Medicaid categories. To qualify for QMB, individual assets <\$4000 and monthly income less than \$716 entitle individuals to coverage of Medicare premiums, deductibles, and coinsurance. SLMB participants have assets <\$4000 and monthly incomes less than \$855. SLMB pays for the Medicare Part B premium.

Health care financing efforts can be subdivided into three general types of health plan. Regressive plans are those in which people with increasing incomes pay a smaller percentage of income than those with lower incomes. In proportional plans the percentage of income for health care stays constant across socio-economic levels, and in progressive

plans, those people with larger incomes pay a larger portion of their income than those with lower incomes. Given these basic definitions, most people would concede that regressive plans are the least reasonable. Unfortunately, the elderly are often subject to regressive plans because of their employment status or because they are unhealthy and utilize the health care system disproportionately. Most people consider the Social Security system, with its required contributions based on a flat percentage of earnings, to be a study in social progressiveness; this is not the case.

A robust history of social science research has found evidence of a widening gap between the life expectancy of high- and low-income persons, and the effect of income appears to be stronger than many other variables that impact mortality such as race and education level (5). Studies of US Life Tables comparing income level and mortality show that the highest-income retiree analyzed has a life expectancy that is about 6% longer than the lowest-income worker studied. Clearly, if Social Security contributions are a constant percentage of wages across a wide range of earnings and if high-income workers live longer, then the income distribution inherent in social security is perverse (5). All participants pay into the system at a level rate, but those with high incomes receive lifetime benefits that are worth more. A large number of variables is likely to contribute to the longevity of the well-to-do, but these aside, economic status profoundly affects use, particularly of the number of doctor visits which, in turn, may be directly related to greater purchase of private insurance (4). Wealthy individuals tend to live longer, and if they use Medicare more intensively because their supplemental insurance eliminates any co-payments, then they will receive greater lifetime benefits than the poor. Thus, the overall effect of Medicare will be regressive.

DOES HEALTH CARE MAKE US HEALTHY?

It is very easy to get mired in the discussion of health care financing and neglect the real question at hand. Do the trillions of dollars spent on health care make us healthy? Clearly, most Americans believe this to be true. However, are we correct? Without a doubt, an examination of life-expectancy patterns throughout the last century would reveal that life expectancy has nearly doubled, indicating a dramatic improvement in the general level of health over that period. However, the characteristics of “modern” medicine—new drugs, advanced technology, and more doctors—probably demonstrated only a peripheral effect on this trend. Far more important were improvements in nutrition and hygiene.

For instance, coronary artery disease is the leading cause of death in most industrialized countries. If the quantity and quality of health care was a key variable, then one would expect relatively poor countries such as Portugal to perform worse than relatively rich countries such as Norway. In fact, the opposite is true. The main variable, borne out in multiple studies, appears to be diet. Countries exhibiting the most frequent incidence of heart disease tend to be large consumers of dairy products and saturated animal fats, whereas those at the bottom of the table tend to use vegetable oils and eat large quantities of fish, fruit, and vegetables. Smoking is also a major factor. In the United States, coronary artery disease and cancers account for over half the deaths from natural causes, and both are strongly associated with tobacco abuse. Heavy smokers are four times more likely to die from coronary artery disease as are nonsmokers, and 40% of all cancer deaths are linked to smoking (6). Neither a medical degree nor an expensive test is required to intervene in the correction of these risk factors.

In fact, this misses the point of much of modern health care. Most treatment provided by doctors and hospitals is not primarily concerned with saving lives but rather with improving quality of life. Modern developments in medical technology, surgical techniques, and medicines have enabled doctors to treat many conditions that previously caused patients considerable pain and discomfort (i.e., stomach ulcers and osteoarthritis). This helps to explain why even with increased life expectancy, the demand for health care seems to be infinite and burdensome—everybody wants improvements to the quality of their life.

We are still faced with the problem of deciding how much health care we need. Some argue that we should aim for the highest level of health care. In opposition to this argument is the debate over whether or not we have a right to a certain level of health care at all. President Clinton campaigned with the slogan: “health care should be a right, not a privilege.” The belief in such a right is widespread, even within the medical profession. The AMA’s “Patient’s Bill of Rights” includes the statement that patients have a “right to essential health care.” The view that there exists some kind of right to a decent minimum of health care, or that the principle of beneficence is enough to justify a rational program of universal coverage permeates much of today’s philosophical literature. Disagreement centers mainly on what constitutes a decent minimum or whether a decent minimum is, in fact, enough to discharge the implied duty of beneficence and the principle of social justice (7). Policy-makers historically have made the assumption that these rights exist and quickly move the discussion forward to questions of practical implementation. Right or wrong, for the past 30 yr, the idea that people have a right to health care has led to greater and greater government control over the medical profession and the health care industry. The needs of the indigent, uninsured, and elderly, among other groups, have been put forward as claims on public resources. In that sense, public policy really dismisses the philosophical debate all together, sacrificing this intellectual endeavor to the will of the electorate.

If we accept this right to be implicit, then the answer to the question of how much health care we should provide is simple. The optimum level of health care is whatever is most efficient—the quantity where marginal cost equals marginal benefit. The questions that remain are which mixture will produce the most efficient allocation of a finite resource, and how can health care be distributed in an equitable manner?

THE BASIS OF HEALTH POLICY

In order to ration health care as fairly as possible, we need a way to measure how much good is accomplished for any given medical therapy. Treatment outcomes and other health-influencing activities have two basic components—the quantity and quality of life. Life expectancy is a traditional measure with few problems of comparison—people are either alive or not. Attempts to measure quality of life is a more recent innovation. Economists have attempted to capture both the quality and quantity elements of a health care outcome in a single measure by developing the quality-adjusted life-year (QALY).

These measurements identify public health trends for strategies to be developed, assess the effectiveness and efficiency of health care interventions, and determine the state of health in communities. QALYs offer the possibility of carrying out effective cost-benefit analysis and thus providing the information we need to make efficient decisions. Some “life-saving” treatments are unpleasant, do not extend life much, and the time remaining is full of pain and discomfort; alternative treatments may not save lives but are not expen-

sive and may considerably improve the quality of life of the patient. An efficient allocation might shift resources from the first type of treatment to the second. QALY gives us a way to mathematically convert the amount of quality added to a person's life into a life-year equivalent. Theoretically, this allows all medical therapies to be compared to each other on an equal basis, whether or not they actually prolong life, and thus allows the numerical ranking of medical services in terms of amount of good they provide.

The basic idea of QALY is straightforward, using a scale from 0 to 1 to assess quality of life, where 1 represents a year of perfect health. Thus, an intervention that results in a patient living for an additional 4 yr rather than dying within 1 yr but where quality of life fell from 1 to 0.6 on the continuum will generate the following:

$$\begin{aligned} & 4 \text{ yr extra life at } 0.6 \text{ quality-of-life values} = 2.4 \\ - & 1 \text{ yr at reduced quality of life } (1 - 0.6) = 0.4 \\ \hline & \text{QALYs generated by the intervention} = 2.0 \end{aligned}$$

Quality-adjusted life-years are a crude measurement, and although they provide the best attempt so far to solve the problem of measuring health care outcomes, they still suffer from a number of serious limitations. A key question is who should make the subjective choices that determine the QALY? Is it health professionals, the general public, politicians, or patients who have the experience of the particular medical condition and treatment? The value of a QALY can change radically according to who is making the choices. Other potential problems include the fact that the responses given are to hypothetical situations and so may not accurately reflect an individual's real decisions and the fact that valuations are influenced by the length of the illness and the way in which the questions are asked. QALYs are likely to undervalue health care, because they do not capture the wider benefits that may be gained, for example, by a patient's family, friends, and even the medical community. Nonetheless, QALYs seem to be the best measure so far for objectifying the benefit of medical therapies—a prerequisite for an ethical rationing system.

Health care decision making can take place at very high levels of abstraction or on a more individualized level. At the broadest level is the question of the most appropriate use of finite resources. It has become increasingly popular to carry out cost-effectiveness analysis in economic evaluations of health care. In cost-effectiveness analysis, costs are measured in monetary units, and health effects in non-monetary units such as life-years or the QALYs gained. The rationale for cost-effectiveness analysis is to maximize the effectiveness subject to a budget constraint. A fixed budget can be used to maximize the health effects based on information about the incremental cost-effectiveness ratios of different health programs that will implicitly yield a price per effectiveness unit or, vice versa, a price per effectiveness unit can be used to establish a budget (8). Fortunately, most physicians only see the end result of these complex economic calculations and usually in the form of clinical practice guidelines (9).

AN OUNCE OF PREVENTION

Arguably, an interest in health policy and economics is not what propelled most physicians through training. However, the implications of these two factors are inextricably woven together in the combined impact of health care and public health measures. The

mortality from coronary heart disease has declined 50% in the past two decades (10). Certainly part of this decline is the result of improved treatments from coronary artery bypass graft procedures, coronary care units, and better emergency response services (11). On the other hand, a majority of this decline was the result of changes in lifestyle, specifically decreased smoking and serum total cholesterol levels in the general population (12). If the decline in coronary heart disease continues, it will be the result of both improved treatments and improved preventive care.

The American health care system has long based its success, and rightfully so, on the introduction of new technology, but there has been increasing recognition of the potential of preventive activities to improve the health of the population. Impressive evidence supports the value of clinical preventive medicine (11). Preventive medicine is defined as the maintenance and promotion of health and the reduction of risk factors that result in injury and disease. There are three main types of preventive medicine: primary prevention aims to prevent a disease from occurring (smoking cessation, diet modification); secondary prevention is the detection and treatment of asymptomatic disease before symptoms occur (antihypertensives, antilipidemics); and tertiary prevention deals with the consequences of existing disease or reduction of recurrent disease (bypass).

In 1997, cardiovascular disease (CHD) claimed nearly 1 million lives in the United States. In 1999, an estimated 1.1 million Americans had a coronary event. Of these, approx 650,000 were first events (13), 25% of which presented as sudden death (14). Recent evidence suggests that 12% of men and 8% of women over 45 yr of age have symptomatic CHD. In 1999, the total direct and indirect costs of CHD were estimated to be \$326.6 billion (13). Obviously, the goal is to reduce the incidence of coronary heart disease, not just its associated mortality. From a cost-effective standpoint alone, primary prevention is the most alluring. However, the benefits of preventive measures are often protracted. Among the American public, there is a general lack of perspective about the relative importance of preventive interventions. The public can be quick to embrace dietary supplements, miracle diets, and sophisticated screening tests without documented benefit, yet often ignore basic health behaviors known to be beneficial. Less than one in three adults consumes the recommended five servings of fruits and vegetables daily, 60% of the US population performs no regular physical activity, and 23% of the population smokes cigarettes (11).

Other than the reliance on the effort of the patient, primary preventive practices face other barriers to widespread adoption. First, although evidence suggests that providing preventative services for Medicare beneficiaries would result in a modest health benefit with no additional cost (11), reimbursement for primary preventive services is generally poor. The reasons for this are multifold. Most prominently, outcome data are difficult to demonstrate. Success is essentially a "non-event." For example, it is easier to recognize the effect of an antibiotic on an infection but much more difficult to document that a premature myocardial infarction was avoided because of diet and exercise counseling. Second, most benefits from primary prevention are seen only after a long period of time. Such up-front investment in the future is not enticing to insurance companies who issue short-term policies or to companies with high employee turnover rates. Finally, the training of physicians often emphasizes urgency of acute problems over chronic problems, encouraging doctors to respond to current problems rather than initiate preventive measures.

As a result, less than 5% of total annual health care expenditures in the United States is spent on primary prevention (11). Far more of our health care dollars are spent on secon-

dary and tertiary prevention; this is particularly true for coronary heart disease resulting from the proliferation of new medicines and the randomized controlled trials proving their benefit. Data from Framingham, the Multiple Risk Factor Intervention Trial, AFCAPS/TexCAPS, and WOSCOP have all shown a relative risk reduction of CHD when cholesterol levels are controlled. Multiple studies, from the SHEP trial to ALLHAT, have done the same for the management of hypertension. Despite convincing data and proven benefits, there are huge budgetary constraints on secondary prevention, and adding prescription drug plans to health benefit packages is a hot topic that brings us back to that familiar question: will health care budgets accommodate advancing technology at rising costs?

Science and technology do nothing to resolve the conflict of who pays. This conflict overshadows the entire sequence of preventive activities, from screening and risk assessment to the choice between lifestyle changes and medication, straight through to the prevention of recurrence. Although cardiovascular morbidity and mortality are problems that are predominantly associated with old age, national and international guidelines for the management of hypertension have only recently begun to include guidance that is specifically directed at the elderly or “very old” segment of the hypertensive population. Whether past neglect was a symptom of “ageism” or merely an assumption that hypertension and cardiovascular disease were conditions of old age anyway and therefore did not merit an age focus is unclear. What matters is that the special needs and problems of the elderly are now being included in guidelines.

The 1999 Guidelines of WHO (World Health Organization) International Society of Hypertension devoted a section to the “very elderly” and drew attention to the fact that there is presently very little evidence to support the health impact of anti-hypertensive treatment on patients over the age of 80. Up to that age, benefits and safety do not differ significantly between younger and older patients, “although the absolute effects are typically greater in older individuals because of their higher risk of cardiovascular events” (Guidelines Subcommittee 5, 1999). The Subcommittee considers the value of antihypertensive treatment of the over-80s as “uncertain,” pending the results of new clinical trials including the very old. The absence of such evidence in today’s sophisticated health care systems is both incomprehensible and inexcusable. Considering the fact that the over-85s are the fastest-growing segment of the population in the industrialized world (15), the sooner evidence is produced, the better.

The same can be said of cholesterol control. There is no evidence to suggest that atherosclerosis presents differently in the elderly. The WOSCOP trial was performed in men up to the age of 64. AFCAPS included men and women up to the age of 73. Both trials showed similar reductions with cholesterol-lowering drug therapy in all age groups studied. No outcome data exist for prevention in persons older than 73 on admission to a trial and no data are available for the very elderly. However, the Scandinavian Simvastatin Survival Study showed that the cost of a year of life gained decreased with age. Because CHD prevalence increases with age, the absolute risk reduction may be higher in the elderly than that demonstrated in the younger individuals who were included in published studies.

If primary prevention is successful, the incidence of a disease decreases. In contrast, secondary prevention does not necessarily prevent disease but, rather, delays the onset of deleterious effects. Realistically, despite our best efforts at behavior modification and medical management, coronary heart disease will likely continue to be the leading cause of death in the United States. Tertiary prevention corresponds with conventional medical care in that it can be considered treatment for an established condition. In the cardiac patient,

tertiary prevention includes surgery, bypass grafting, angioplasty, and coronary care unit admissions for patients with acute events or exacerbation of chronic conditions.

Tertiary interventions, like coronary artery bypass grafting (CABG), represents a good value per QALY for younger patients, but the procedures are very costly, which warrants attention from policy-makers and economists with a special focus on whether these surgeries are cost-effective in the elderly population. The decision to provide tertiary intervention to this age group should be based on the same criteria used to make the determination in other age segments. In short, the decision that CABG should be performed in seniors depends primarily on three criteria: efficacy, effectiveness, and cost-effectiveness (16). There are relatively little formal data on the use of surgical intervention in the elderly, because historically they have been considered poor surgical candidates; however, improved surgical practices and better overall health among the aging population have started to change this perception. Data are emerging that show elderly patients with coronary artery disease who undergo the surgery live longer and enjoy a better quality of life than those who are “medically managed” with drugs (17). Since the mid-1980s, the number of bypass operations performed on octogenarians has increased more than 15% a year and is expected to increase even faster as the population ages and surgical techniques improve. Researchers estimate that more than 30,000 bypass surgeries will be performed on those 80 and older by the year 2050, at a cost exceeding \$1.2 billion (17).

With such a high cost burden, cost-effectiveness is a crucial determination. Researchers estimate that octogenarians who undergo the surgery have an average of 10.9 more years to live. The total average cost of surgery for the group they studied was \$45,000. Assuming the cost of the procedure and postoperative course to be as high as \$60,000, the cost per year of life saved would be roughly \$5500. Because the benchmark for “cost-effectiveness” is \$50,000 per year of life saved, the surgery seems to be an effective intervention (17). No one would argue that preventive efforts should focus on preventing surgery-requiring conditions from developing, but with new data suggesting both efficiency and effectiveness as well as growing numbers and political influence among the older demographics, it will be increasingly more difficult to argue against surgical intervention in this age group when warranted.

BOOM OR BUST: *HEALTH CARE IN THE NEXT CENTURY*

The health care system in which we currently work emerged fewer than 50 yr ago. The Medicare and Medicaid programs are barely 35 yr old, and managed care only became a significant force less than 10 yr ago. Given the brief history of the nation’s health care system, the constancy of change is not surprising. We have yet to devise a solution that will ease the struggle we have encountered with advancing technology, new health care management approaches, and the perception that no matter how the numbers are crunched, there does not seem to be enough to provide everyone with the highest level of care.

The US population is both growing older and becoming more ethnically diverse. These demographic trends, especially as they relate to the “baby-boom” generation (i.e., Americans born between 1946 and 1964), will have a profound effect on the future of health care delivery. The health care industry must plan for the anticipated health care needs of the baby boomers, the fastest-growing segment of the population, as they age. Just as this cohort has transformed the workplace and government, as the boomers age and increas-

ingly interact with the health care system, their expectations and preferences will also inevitably transform the health care industry.

The involvement of these patients in their own care may be significantly different from that of past generations of older Americans. They may accelerate the move toward self-care and wellness, dramatically changing the physician–patient relationship. With advances in health and medical technologies, boomers will experience extended longevity and may lead more active and productive lives rather than simply retiring at what is considered to be a traditional retirement age.

The full impact of the aging population will not be evident until after 2010, when the initial group of boomers reach retirement age. Indeed, it will not be until 2030, when the youngest members of the cohort reach 65 and the entire boomer population's health care will be subsidized by Medicare, that the nation's health and welfare system is expected to experience the actual social and economic impact of this large cohort.

Along with this demographic shift, the burden of disease is shifting toward chronic illnesses that emanate from our behaviors. It is projected that by the year 2010, the average life expectancy will be 86 yr for women and 76 yr for men (18). Many chronic illnesses, such as cardiovascular disease, most frequently occur in the later years of life. Increases in life expectancy and the proportion of elderly people will be accompanied by an increased prevalence of chronic disease, which will need chronic management. More than ever, the expense of prescriptive medications will need to be addressed.

In 1999, the average Medicare beneficiaries spent nearly \$400 out of pocket on drugs. Seniors who cannot afford to pay for their medications often neither fill the necessary prescriptions nor take their medicines irregularly. The consequences can be dangerous or even deadly. Original Medicare does not cover the cost of prescription drugs outside of the hospital, which means that more than one-third of Medicare beneficiaries lack coverage for outpatient prescriptions. The coverage gap will only grow wider as drugs grow more expensive and more important in treating the ills of old age. Drugs are more expensive in the United States than they are in any other industrialized nation because we have fragmented our purchasers so extensively. The Veteran's Administration and large HMOs pay substantially less for prescription drugs than do Medicare beneficiaries, who pay retail. Exorbitant costs paid by the American public subsidize the drugs consumed in Canada and Europe, where regulation of costs is tighter. Furthermore, the amount of money that pharmaceutical companies are spending in direct-to-consumer marketing is costing billions per year, taking therapeutic choice out of the hands of the physician and driving up both consumer demand—often without medical indications—and costs. America is the only industrialized nation with a free market for pharmaceuticals and without government restraints on drug prices. Although this is, in part, meant to provide the capital needed for innovation, it is obvious that the application of innovation will be hindered if the cost is prohibitory.

The cost of prescriptions is just one of many issues policymakers will have to tackle as they begin to address the health care needs of the growing number of elderly Americans. We will need to commit more resources to research into the diseases of aging, train more health care professionals to understand the needs of this population, make disease prevention a national priority, orient the health care system's incentives toward healthy aging, make more provisions for long-term care, correct the depletion of Medicare's Hospital Insurance Trust Fund, and establish a more humane and cost-effective approach to death and dying (19).

GLOSSARY

- Adjusted average per capita cost (AAPCC):** The basis for HMO or Clinical Management Program (CMP) reimbursement under Medicare-risk contracts. The average monthly amount received per enrollee is currently calculated as 95% of the average costs to deliver medical care in the fee-for-service sector.
- All-payer system:** A system in which prices for health services and payment methods are the same, regardless of who is paying. Establishing a uniform fee bars providers from shifting costs from one payer to another.
- Assignment:** A process in which a Medicare beneficiary agrees to have Medicare's share of the cost of a service paid directly (assigned) to a doctor or other provider and the provider agrees to accept the Medicare-approved charge as payment in full. Medicare pays 80% of the cost and the beneficiary 20%.
- Balance billing:** In Medicare and private health insurance, the practice of billing patients for charges that exceed the amount that the health plan will pay. Under Medicare, the excess amount cannot be more than 15% above the approved charge.
- Capitation:** A method of payment for health services in which an individual or institutional provider is paid a fixed amount for each person served without regard to the actual number or nature of services provided.
- Cost analysis:** The direct budgetary costs to health agencies.
- Cost-benefit analysis:** An analytic method in which a program's cost is compared to the program's benefit for a period of time, expressed in dollars, as an aid in determining the best investment of resources.
- Cost-effective analysis:** A form of analysis that seeks to determine the costs and effectiveness of a medical intervention compared to similar alternative interventions to determine the relative degree to which they will obtain the desired health outcome(s). Measures output in terms of health gains (not monetary).
- Cost-utility analysis:** A form of analysis that measures changes in quality of life and takes into account the patient's perspective of personal quality of life.
- Diagnosis Related Groups (DRGs):** Groupings of diagnostic categories drawn from the International Classification of Diseases and modified by the presence of surgical procedure, patient age, comorbidities, complications, and other relevant criteria. DRGs are the case-mix measure used in Medicare's prospective payment system.
- Effectiveness:** A measure of the increased health benefit provided by a program or treatment.
- Efficacy:** The extent to which a specific intervention, procedure, regime, or service produces a beneficial result under ideal conditions.
- Efficiency:** Delivering an effective intervention at the lowest possible cost.
- Medicare + Choice:** A Medicare program established by the 1997 Balanced Budget Act, it allows Center for Medicare and Medicaid Services (CMS) to contract with a variety of different managed care and fee-for-service entities offering greater flexibility to Medicare participants.
- Medigap policy:** A private health insurance policy offered to Medicare beneficiaries to cover expenses not paid for by Medicare. Medigap policies are strictly regulated by the federal government. Same as Medicare supplemental definitions are those of the Academy for Health Services Research and Health Policy.

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