ECONOMIC IMPACT AND COST-EFFECTIVENESS OF MEDICAL TECHNOLOGY
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A major contributor to the rising costs of health care in the United States has been the increasing use of medical technology. Costs of equipment, of procedures made possible or more frequent by new technology, and of procedures induced by the diagnostic information or therapeutic consequences of technology, all contribute.

Cost-effectiveness analysis has been proposed as a method by which to evaluate the health benefits of a technology in relation to its net economic impact, so that priorities for the use of limited resources can be set. Cost-effectiveness analysis may be of value to policymakers, fiscal intermediaries, health care institutions, and clinicians, although current institutional incentives do not favor its rapid dissemination.

Recent applications of cost-effectiveness analysis to interventions in cardiovascular disease suggest that coronary artery bypass surgery for multiple vessels, coronary angiography in definite angina, and treatment of moderate to severe diastolic hypertension are all relatively cost-effective, while screening for coronary disease using radionuclide scanning or angiography, and treatment of borderline hypertension are substantially less cost-effective. Coronary artery bypass surgery for single vessel disease, screening of asymptomatic adult males with exercise stress testing, screening for hypertension, and treatment of mild hypertension are intermediate in their cost-effectiveness.

Limitations of cost-effectiveness evaluations include their reliance on subjective estimates of uncertain effects of treatment, their sensitivity to value judgments concern-
ing health outcomes, and the danger that other social values such as interpersonal equity, or psychological factors such as the patient's anxiety, may be ignored. Nonetheless, such economic evaluations should complement evaluations of clinical efficacy in guiding the use of medical resources by providers and policymakers.

### Medical Technology and the Rise in Health Care Costs

In 1981, the United States will have spent over $260 billion on health care (Freeland et al., 1980). During the 1970s, expenditures on health care tripled, increasing at double-digit rates in every year, and averaging 14.7 percent per year. Meanwhile, the consumer price index was increasing by less than half that rate (U.S. Department of Health and Human Services, 1980). It might be suspected that population increases, or shifts in the age distribution toward the elderly, might account for these trends; however, a study which adjusted for inflation, age mix, and population size found that the real, age-adjusted, per capita expenditure on health care rose by 4.5 percent per year. As a fraction of the gross national product (GNP), health care's share has increased steadily, from 3.5 percent in 1929, to 5.3 percent in 1960, to 7.6 percent in 1970, to more than 9 percent in 1980 (U.S. Department of Health and Human Services, 1980).

A much analyzed question is to what degree technology has contributed to the increase in medical care costs (Banta et al., 1981). To begin to address this question, one needs a definition of medical technology, and I shall adopt the one proposed by the Office of Technology Assessment:

"The drugs, devices, and medical and surgical procedures used in medical care, and the organizational and supportive systems within which such care is provided." (Office of Technology Assessment, 1978a).

New technology, then, includes but is not limited to new drugs, new procedures--either equipment-embodied (such as computed tomography) or not (such as coronary artery bypass surgery)--and new modes of delivery (such as neonatal and coronary intensive care units). Much of the research to which I have referred has concentrated on hospital costs, and is based on the premise that increases in price-adjusted costs per hospital day may be attributed, by default, to technology. Thus, of the average annual increase of 14.7