POLICY FORUM: MEDICINE

# Effects of Medical Research on Health Care and the Economy

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One of the most serious problems to face the U.S. health care system and the U.S. economy in the 21st century will be the demographic shift caused by the aging of the "baby boom" cohorts (persons born 1946 to 1963). The federal share (25%) of today's $1 trillion health care bill is projected to grow to 50% of a $1.6 trillion to $2.3 trillion bill in 2015. In a 1997 report to Congress, the American Academy of Actuaries estimated that to maintain Medicare solvency through 2070 immediate benefit cuts of 60% were necessary—equivalent to the elimination of nearly all in-hospital care for people over 65. Without drastic service reductions, Congress must raise Medicare payroll taxes fourfold or return to deficit spending.

This situation cannot be solved by moving seniors into managed care and capping health costs. Current experience with managed care suggests that most real savings from fee-for-service inefficiencies have been achieved, and further major savings as a result of increased efficiency (as opposed to service reductions) are unlikely. This is especially true as health maintenance organizations (HMOs) begin to compete with each other for market share in increasingly saturated markets where they are less able to control expenses by excluding seriously ill and costly patients (*1*). HMO efforts to reduce costs under competitive and market constraints now threaten the quality of care and create dissatisfaction among both patients and physicians. These problems, plus frequent denial of experimental treatments (especially for terminal diseases) and recent cases of major Medicare fraud are causing state attorneys general to increase oversight of operation of managed care plans and for-profit hospitals (*2*).

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Solving the problems of rising health costs and population aging requires understanding the complex, and rapidly evolving, relation of new health care technologies and the economy. Many of the factors that could improve health and lower costs in future decades are linked to new research developments in biotechnology. Furthermore, one should not focus only on complex, capital-intensive treatments. Biotechnology also includes efforts to prevent disease or improve health through, for example, enhancement of the micronutrient profile of specific foods (*3, 4*) or addition of antibiotics to control infectious agents that contribute to chronic disease.

We suggest that seven factors will combine to rapidly alter medical knowledge and practice, health delivery and outcomes, and total health costs.

*Declining disability among people over 65.* The National Long Term Care Survey (*5*) tracked health changes in the Medicare population aged 65+ from 1982 to 1994. The age-adjusted chronic disability prevalence rate declined 1.3% annually over the 13 years. Recent declines in disability rates are consistent with the introduction of new biotechnologies due to the maturation of major areas of biomedical research (for example, better drug treatments of osteoporosis, stroke, Parkinson's disease, and congestive heart failure).

Manton and Singer (*6*) see health costs as less a function of the percentage of elderly in the population, than of the percentage of chronically disabled in the elderly population. What impact will disability decline have on costs? Because chronically disabled individuals over 65 have health costs seven times those of healthy individuals, the crucial ratio is that of Medicare's fiscal burden of disabled elderly to younger workers (age 18 to 64) contributing payroll taxes. If this "dependency ratio" were kept constant for 40 years, that would contribute significantly to keeping the Medicare Trust Fund solvent—even as baby boom cohorts reach eligibility. The dependency ratio can remain steady, and a cost crisis averted, by maintaining at least a 1.5% annual decline in chronic disability prevalence, assuming the cost of reducing disability does not consume most savings.

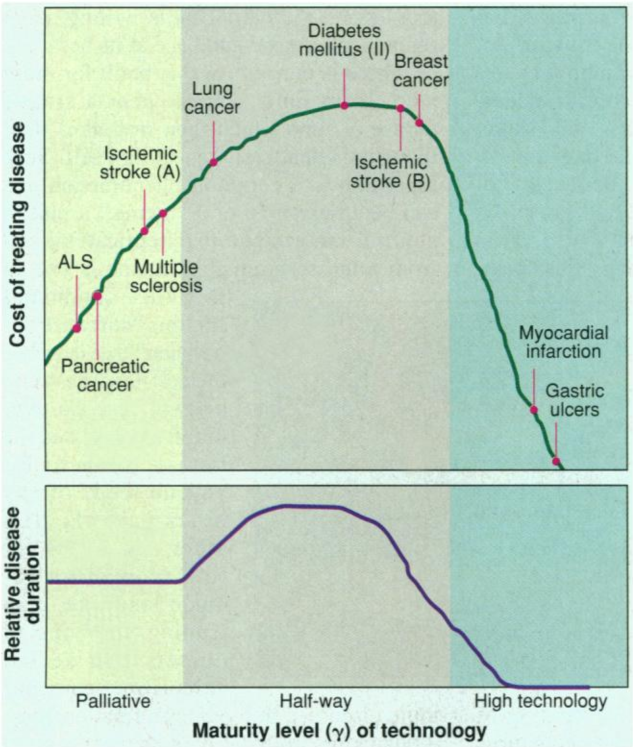
*The changing paradigms of medicine.* Conventional economic thinking suggests that new medical technology for improving the health of seniors often increases costs and absorbs savings as a result of better health. But technological advances are defining new paradigms for medicine to which traditional economic theory may not apply. Improved understanding of human biology at the molecular level may make invasive surgery, intensive care units, and long-term nursing home care far less necessary. Those costly (and often clinically inadequate) interventions could be replaced by genetically engineered pharmaceuticals and other treatments (such as gene therapy) targeting the molecular basis of disease. Unraveling the human genome may allow us to intervene in many diseases before they become symptomatic.

Thomas (*7*) and Weisbrod (*8*) assessed the technological route, and subsequent cost evolution, for given diseases. In coming decades, a new medical paradigm could lower costs for many diseases as interventions change their outcomes (see figure).

The use of tissue plasminogen activator (tPA) to treat acute ischemic stroke is a good example of a recent clinical advance in which technology could produce cost savings (*9*). Using data from the NINDS rt-PA stroke trial, Fagan *et al.* (*9*) found that hospital length of stay was shorter for treated patients, and that more treated than untreated patients were discharged to home (rather than to institutional) care. This increased hospital costs (as a result of hemorrhagic stroke) by $1.7 million per 1000 patients, but decreased rehabilitation and nursing home costs by $6.2 million—a net savings of $4.5 million per 1000 treated stroke patients. Not only do costs decline but quality of life improves—564 quality-adjusted life years were gained per 1000 patients over their remaining life-span.

This first-generation innovation might move stroke therapy from palliation range to a "half-way technology" status (position B in figure) because only a proportion of ischemic stroke cases benefit. A decade from now, however, there may be a "cocktail" of stroke treatments for different stages of the pathological process, such as neuroprotectants to shield nerve cells during a stroke, new clot-dissolving drugs, longer lasting neuroprotectants to prevent secondary pathological events, maintenance therapy (such as blood thinners), and, eventually, drugs to help nerve cells reconnect in the brain.

*The paradox of extended longevity.* Better therapies, applied earlier, may both improve function and extend life. Conventional wisdom suggested that more old people, living longer, would increase health costs. Paradoxically, the opposite appears true. Lubitz and Riley *et al.* (*10*) found that health costs in the last 2 years of life declined in persons dying at later ages. Health treatments of a person dying at 67 cost three times as much in the final 2 years of life as of a person dying at age 90.




**Evolution of medical technology for selected diseases (*8*).**

Thus, if you deposited all the money needed for health care for the rest of your life into an interest-bearing account, at age 65 you would need to deposit less if you live to 85 than if you live to 75. Lower costs in the last 2 years of life, and lower average annual costs, are desirable because Medicare is a pay-as-you-go fund. Evidence suggests that lower health maintenance costs for survivors to age 90 (for example) are due to those persons avoiding the early risk of many chronic diseases (*11*).

*Revolution in pharmaceutical R&D methods.* Savings resulting from new medical knowledge will be multiplied by the ability to screen promising compounds at rates unimaginable a few years ago. Miniaturization and robotic chemistry, allied with genetics and high-throughput screening and bioinformatics, both provide a clearer picture of drug efficacy before clinical trials and may reduce certain pretrial drug development costs by a factor of 100 or more (*12*). The savings from such streamlined R&D methods, if reinvested in newer technologies or used to lower drug prices in competitive markets, might reduce health costs and produce drug therapies that could replace (along with improved diagnostic imaging procedures) many types of invasive surgery.

*Increasing public expectations about health at later ages.* The over-65 cohort is increasingly knowledgeable about medical issues, because of increased coverage of medical advances by the media and because of their improved education (*13*). A better-educated public will be driven by rising health expectations, especially at later ages, to make behavioral changes identified by biomedical research as improving health. As individual behavior changes, more elderly people will remain active, independent, and out of the formal medical care system (*14*). How behavior affects health is a crucial area of biomedical research.

*Labor productivity as a function of improved health.* Decreased morbidity will affect the economy by reducing lost work time for patients and their family caretakers, increasing the productivity of the labor force, and extending it in older populations. For example, acute illness costs roughly $103 billion annually in lost labor—not counting caregiver costs or the effects of chronic conditions. Extending the productive years of older individuals makes it more feasible to raise the age of Medicare and Social Security eligibility to protect their solvency (*15*).

*Growing importance of biomedical technology to the economy.* Beyond its impact on individual health, biotechnology is an important engine of U.S. economic growth in creating jobs and global competitiveness. Biotech industries could experience growth similar to that of the computer industry over the past 20 years, generating hundreds of start-up companies and several hundred thousand new jobs (many highly skilled and well paid), and increase the U.S. gross domestic product (GDP). Increasing the GDP faster than the burden of health care (currently 15% of GDP) will help maintain an affordable ratio even with the coming demand for services by aging boomers.

Some argue that improved biotechnology increases health care demand and increases the proportion of the GDP dedicated to health care. However, demand is not totally elastic. For life-threatening conditions, treatments are often so rigorous that no one undergoes them except under dire necessity. An increasing proportion of GDP spent on health care is not necessarily an adverse outcome if growth of other economic sectors is stimulated, and if some health services purchased represent new products fulfilling previously unmet needs.

It is also possible that the proportion of GDP dedicated to health care might not increase. Sales of biotechnology products in a global market increase U.S. GDP but not domestic health costs. Biotechnology generates numerous applications in non–health care sectors [for example, improving plant genetics and food production, environmental clean-ups (oil-eating bacteria), and development of organic compounds with novel industrial applications] that stimulate economic growth of non-health sectors (*16*). Finally, improved health may increase GDP beyond the health care investments needed to achieve it. The ability to effectively manage osteoarthritis would affect the number of years workers can be productive, or retirees can be physically active, thereby increasing consumption of leisure industries, transportation, and other services and goods.

Looking at health care as a multicomponent dynamic subsystem of the U.S. economy allows us to appreciate the multiplier effects biotechnological innovations may produce to control future costs. However, there may be a 15- to 20-year lag between a scientific observation and its clinical implementation. We must increase investment heavily in biomedical research to realize benefits in time to control the impact of Medicare costs.

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