

presidential address

Critical care tomorrow: economics and challenges

W. LEIGH THOMPSON, PHD, MD

*Ah, fill the Cup:—what boots it to repeat
How Time is slipping underneath our Feet:
Unborn TO-MORROW, and dead YESTERDAY,
Why fret about them if TO-DAY be sweet!*
Edward Fitzgerald
The Rubáiyát of Omar Khayyám, 1859:37

Like Monarch chrysalides who, armored with Asclepiadean digitalis, spring forth to flutter a continent to their destinies, critical care has emerged from the cocoon of its primary specialties flashing and golden. Shall we grow to envelop our goal, or serve as an emetic brunch to pulmonic prey?

Like other adolescents, we can at least anticipate slowed growth. In 11 years, the Society of Critical Care Medicine has grown from 24 to 1800 on a monoexponential growth curve with a doubling time of 643 days. Unchecked, on June 3, 2021, we would be 10 billion and have only ourselves to treat. Everyone on a roller coaster, ratcheting up the first incline, expects change. We could smile, eyes closed, visualizing a mountain of calm before the descent. I hope to propel you, eyes wide, knuckles white, pores moist to the front row as we perceive the slowing of the summit.

Figure 1 illustrates how rapidly our health care costs have risen from a base of \$2.8 billion in 1935 to more than \$250 billion today.¹ Shall we be spending \$758 billion in 1990?² With inflation, you may ask if \$1 billion will buy a gallon of gasoline in 1990 (Fig. 2). But our health costs rise even as a percentage of our output (Fig. 3) from 3.5% in 1929, to more than 10% now and a projected 11.5% in 1990.^{1,2} The proportion of health care costs attributable to hospital care has risen (Fig. 4) so that the percentage of gross national product spent in hospitals has increased more than 5-fold from 0.7% in 1929 and it may reach 5.1% in 1990 (Fig. 5).^{1,2}

What are the causes of this increase in hospital costs? The number of hospitals has increased only 18% in 3 decades (Fig. 6).³ But the number of hospital beds has increased 96% (Fig. 7) with a slightly increasing frequency of admissions per bed (Fig. 8) and a nearly constant occupancy (Fig. 9).³ Even though hospitals are now larger (Fig. 10) and could be more efficient, their

costs have increased both in real money (Fig. 11) and when expressed in constant 1979-equivalent wealth (Fig. 12).³

Two components of the increased cost per patient day of our hospitals have been the hardware investment per bed (Fig. 13)^{4,5} and the increased total number of personnel serving inpatients (Fig. 14). As shown in Figure 15, the personnel per patient has doubled in 3 decades.³ Inpatient costs per day, calculated in wealth equivalent to 1979 dollars, have risen even more rapidly than the number of persons serving each patient (Fig. 16).

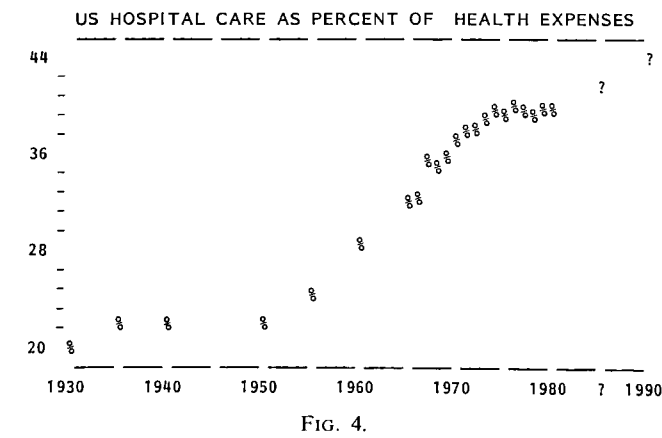
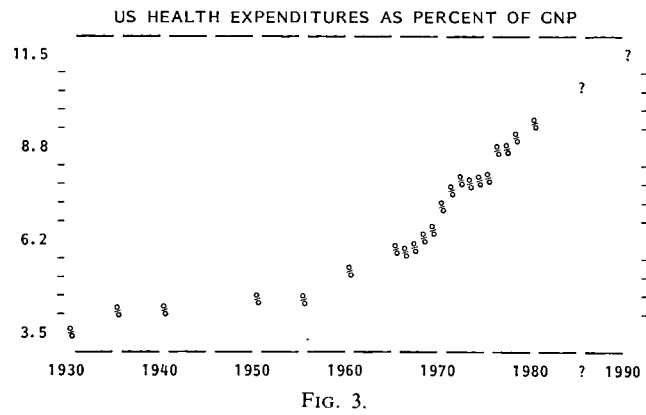
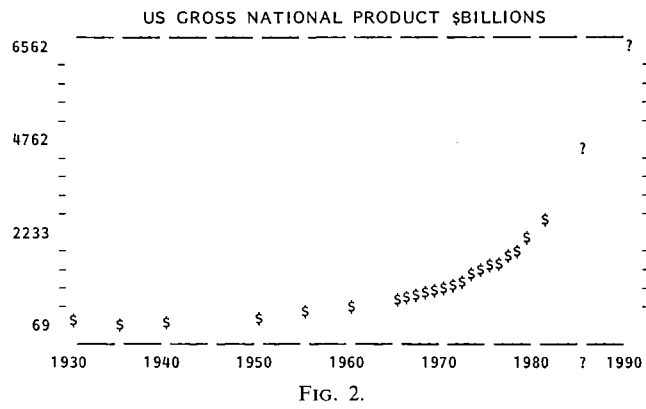
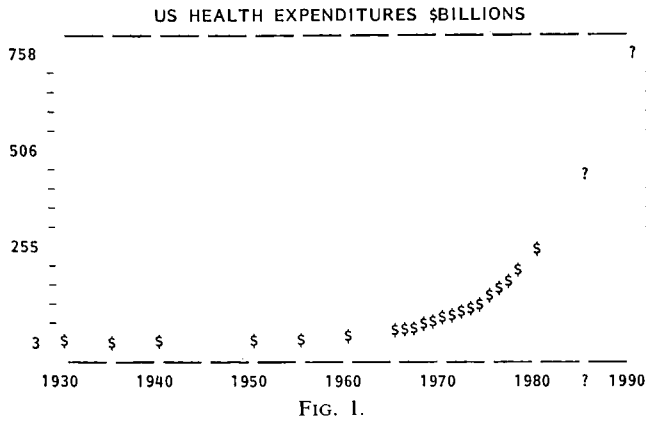
In this decade, the increase in hospital costs has outstripped inflation as measured by the consumer price index (Cpi) as shown in Figure 17.^{6,7} Upon whom has this burden fallen? In the last 3 decades, the patient has paid less and less of the direct hospitalization costs, shown in Figure 18 as (*P*), with a greater proportion falling to insurance (*I*) and government (*G*).^{6,7} Thus, the dollars per day of care paid directly from the pocket of the patient to the hospital have changed little until the last 3 years (Fig. 19) when calculated in wealth equivalent to the 1979 dollar.^{6,7}

Each physician practicing today is "responsible" for about \$1,000,000 each year of health care costs. Yet his remuneration has not grown apace. Figure 20 illustrates the average annual net income, in thousands of 1980-equivalent dollars, of surgeons (*S*), anesthesiologists (*A*), internists (*I*), and pediatricians (*P*).⁸ Since the founding of the Society of Critical Care Medicine in 1971, annual net income of the consumer⁹ has increased 109% while that of the four specialist physicians has increased 72–85%. The growth in assets per bed, the growth of personnel per bed day, and the shrinking reimbursement of critical care physicians reflect the replacement of healing hands with machines and technologists.

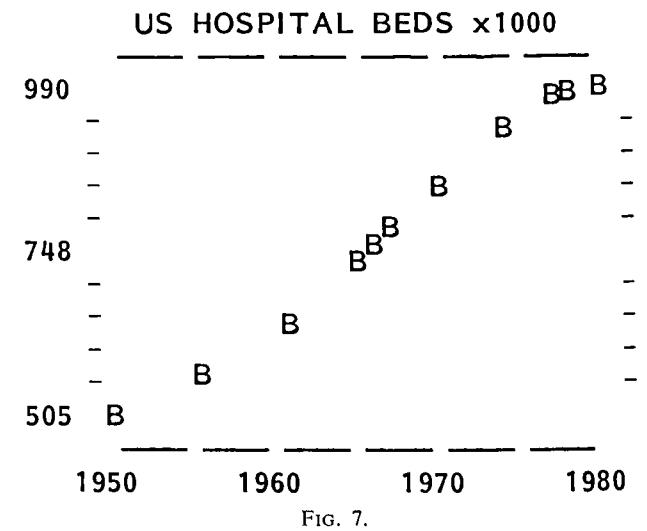
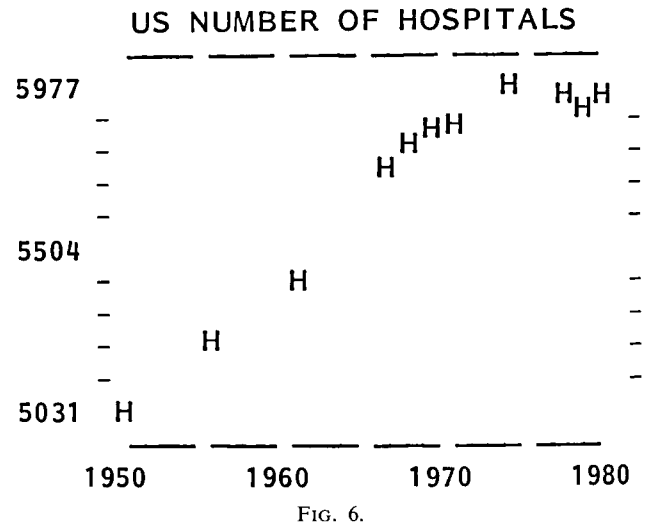
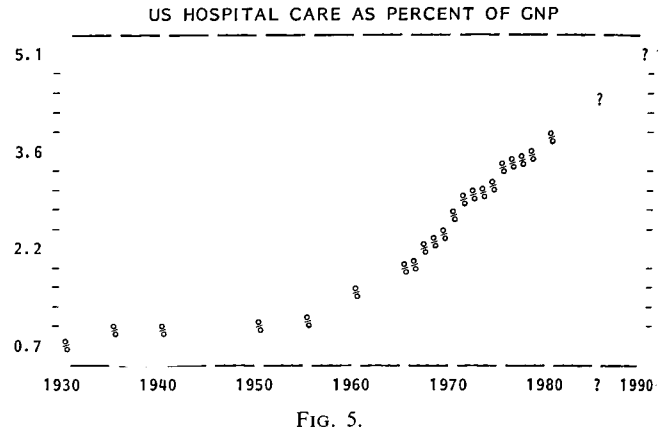
Four factors operating sequentially but in concert have led to the current health cost inflation (Fig. 21). The boom during recovery from World War II and during the Korean conflict gave United States families a home, two cars in every garage, three children, and forecasts of wealth. With the camaraderie of war and the disposable income of winning, egalitarianism prevailed and the new deal became the great society. Hill-Burton built hardware, Medicare and Medicaid paid for care, and Capitation created more physician specialists. All might have been contained had not these investments paid off in

From the Department of Medicine, Case Western Reserve University and University Hospitals of Cleveland, Cleveland, OH.

Address requests for reprints to: W. Leigh Thompson, PhD, MD, Eli Lilly and Company, 307 East McCarty Street, Indianapolis, IN 46285.



new knowledge, new technologies, and new costs. Did the pioneers of the 1950s envision bone marrow transplantation, coronary artery bypass grafts and hemodialysis? They certainly didn't plan to pay for them. Bone marrow transplantation costs about \$443,000 per leukemic patient saved or about \$125,000 per aplastic ane-



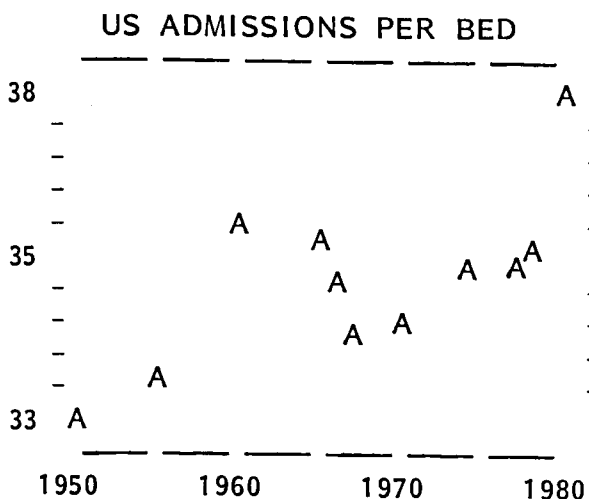


FIG. 8.

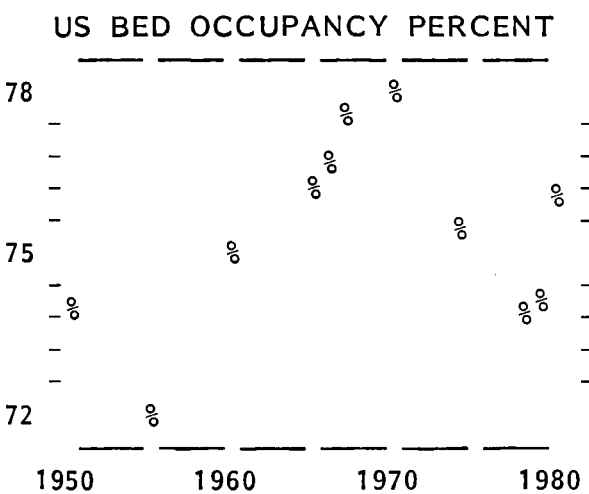


FIG. 9.

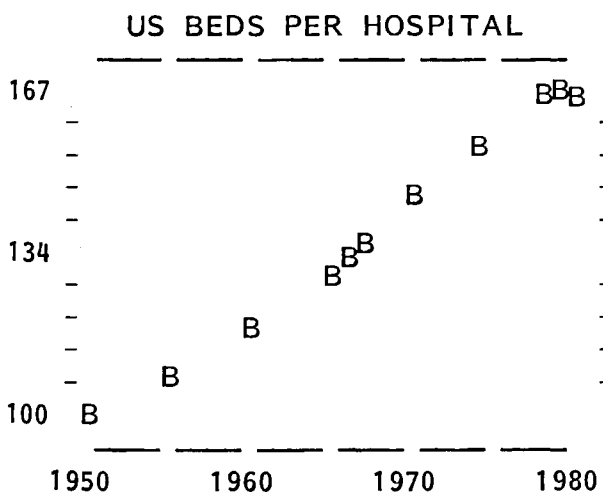


FIG. 10.

as in their formative years, the impact would be manageable. In the 1960s, to receive hemodialysis a patient had to have three graduate degrees, a loving family, a friend on the Board of Trustees, and a tendency to walk

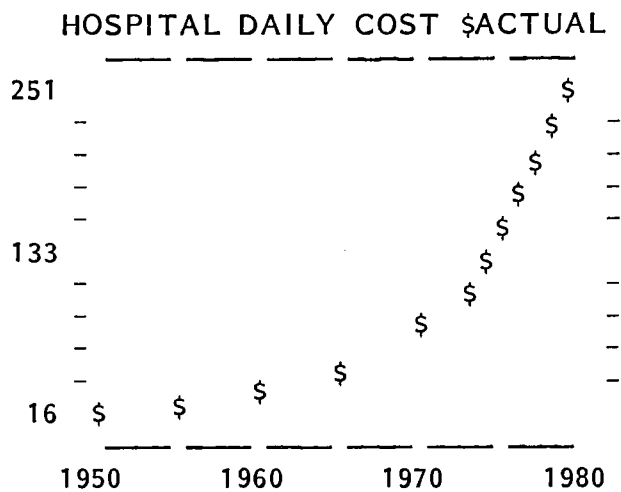


FIG. 11.

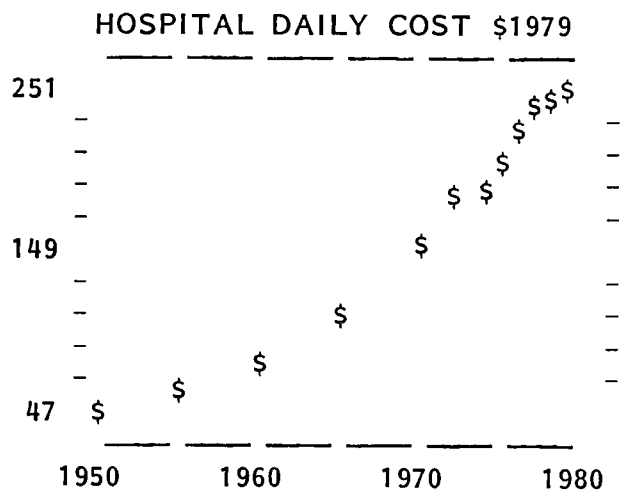


FIG. 12.

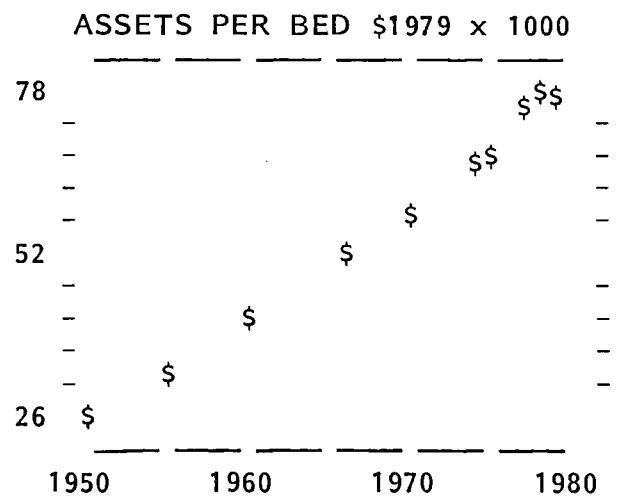


FIG. 13.

mic patient saved. Coronary Artery B Bypass Graft E s may be a \$2 billion a year analgesic. Hemodialysis costs \$1.8 billion a year for 72,000 uremic subjects.

Were aggressive therapies restricted to a few patients,

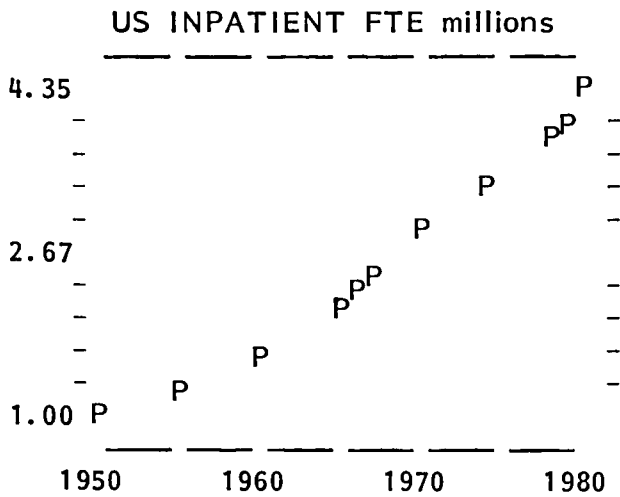


FIG. 14.

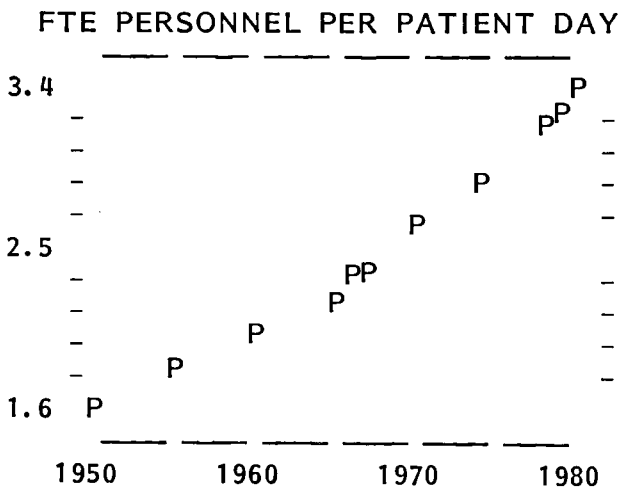


FIG. 15.

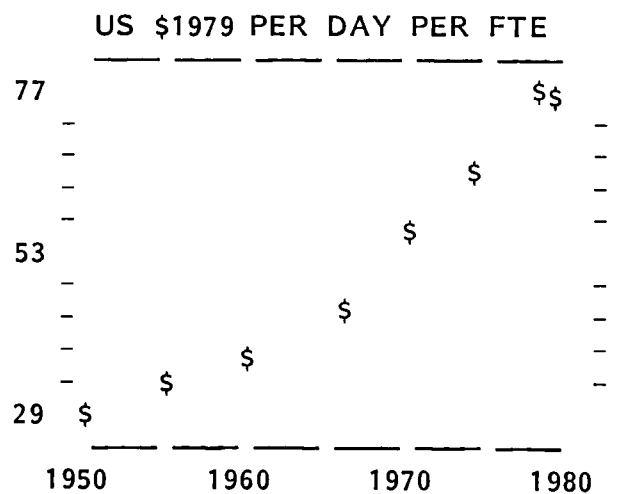


FIG. 16.

on water. Today, a heartbeat is sufficient. Is this only mountain climbing—we do it because it's there, it's possible! Or have reimbursement formulae influenced care? If two lenses or knees are replaced at once, the

allowable fee is often 1.5 times that for one procedure. Does that necessitate two admissions with two anesthetics? If a tiny piece of synovium is removed while looking into a knee, the synovectomy is worth 160% the

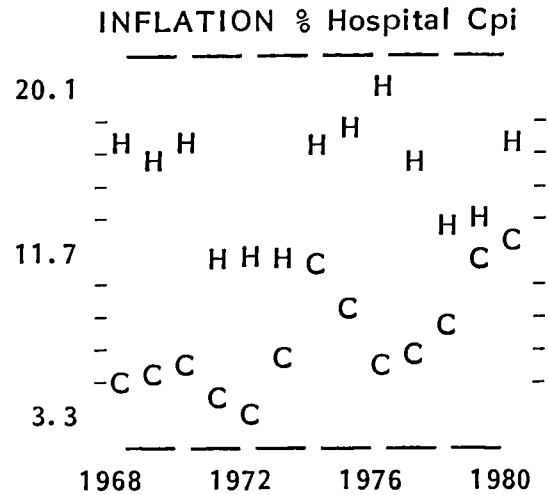


FIG. 17.

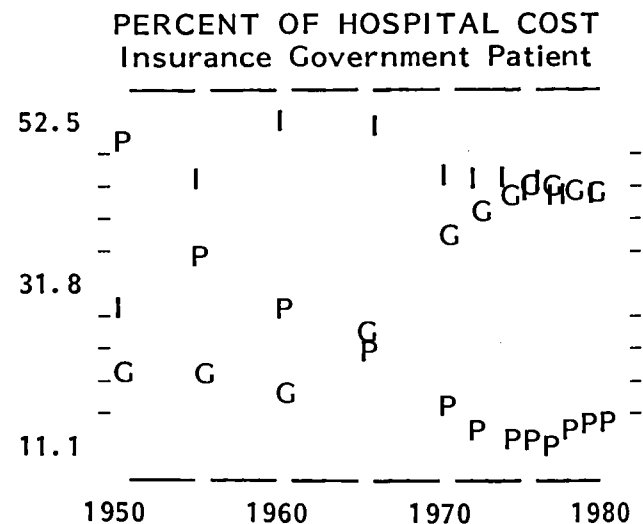


FIG. 18.

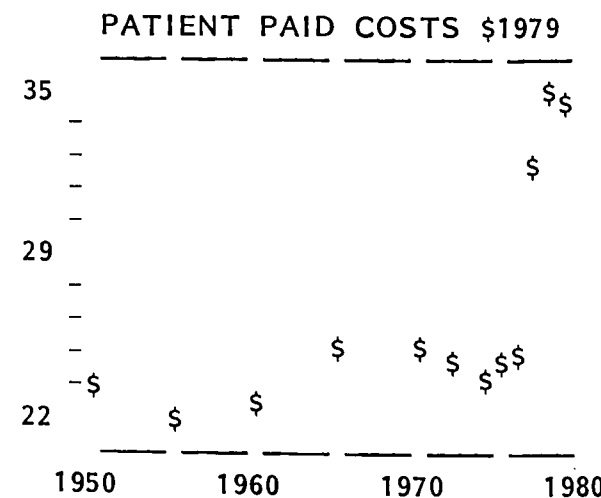


FIG. 19.

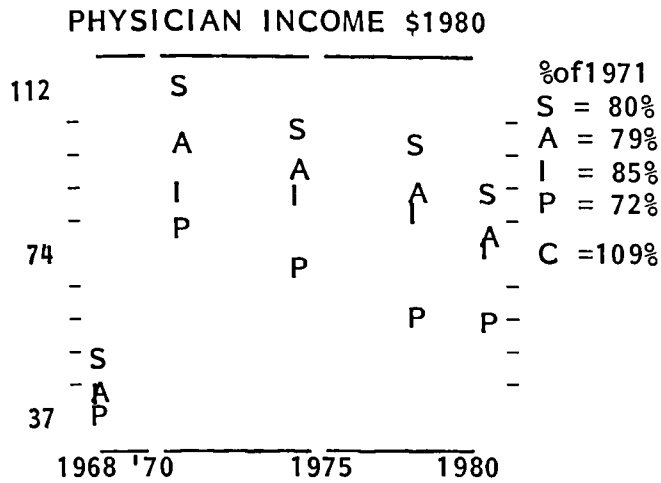


FIG. 20.

INFLATION

1950's
HIGHER STANDARD OF LIVING

1960's
MEDICARE AND MEDICAID

1970's
NEW TECHNOLOGIES

1980's
SYSTOLES SANS SYNAPSES

FIG. 21.

allowable charge for arthroscopy. Are there any knees unbiopsied? During a lumbar puncture, an extra \$25 may be charged for the unproductive deadly Queckenstedt test. How many brainstems were toothpasted by that policy?

Hospital administrators have been offered similar carrots. Third-party payers provided 100% reimbursement for supplies, no matter how extravagant they were. Why haven't our patients' buttocks been pampered on mink pads? All personnel were allowed. Debt service for new machines, new buildings, new services was 100% passed through to reimbursement sources. The patient never knew, he only demanded better food and a visitor's parking lot. The physician obviously wanted nurses, the newest accelerator, and a staff parking lot. The administrator had new toys, more beds, better publicity. Inflation? How could it have been otherwise?

In traditional economic terms, the hospital cost inflation has resulted from "demand-pull" and "cost-push" forces acting virtually without restraint (Fig. 22). In medical terms these economic factors might be expressed differently, but the results are the same. The CANS have increased; we can dialyze everyone, hemophilic factor is available. They are the demand. The MUSTS spring from

CANS + RIGHTS and this conjunction begets more MUSTS. Can this cycle end before we all turn to tiger butter?

To deflate escalating hospital care costs, we can do three things (Fig. 23). What can we perceive as current activities in these areas? First in demand, we can observe lip service being paid to health maintenance organizations and coinsurance with patients. But we hear the thunder of the ads for greater coverage, higher limits, extended benefits. Now workers have drug insurance, alcohol insurance, dental insurance, chiropractic insurance. No mouth gleams as full of karats as that of a Detroit auto worker. What of the government? Do recent decisions limit medical care demands? In Detroit in February 1982, the 12-yr-old victim of rape was forced to have a caesarean section when a judge refused permission for the requested abortion. In Indiana in April 1982, parents and physicians of a severely malformed Down's syndrome baby with esophageal atresia and endocardial cushion defects decided against operation, though the county prosecutor carried the case to three local courts and was preparing an appeal to the U.S. Supreme Court. In similar cases in Illinois, such babies were made wards of the court and surgery, against the wishes of the parents and physicians, was ordained.

If demand is only to be increased by governmental action, will government also provide the supply? No longer. Now we live in an era of caps on hospital costs, of certificates of needs, of diminishing reimbursement. These work. Figure 24 shows the annual percent increase in hospital expenses in three groups of states.¹⁰ (T) symbolizes states with tough regulation of charges, (R) shows those with modest regulations, and (U) shows those that are unregulated. How much longer will (U) fail to convert to (T)?

The effects of such discrepant policies on health care

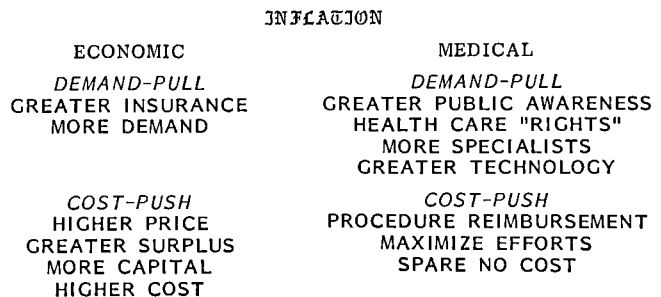


FIG. 22.

DEFLATION

DECREASE DEMAND
LIMIT SUPPLY
IMPROVE EFFICIENCY

FIG. 23.

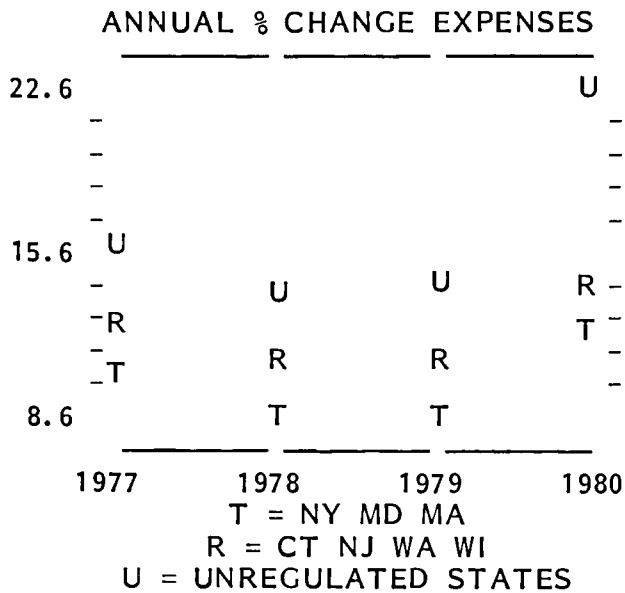


FIG. 24.

supply and demand may be seen already. On May 6, 1982, John L. Lacy, a 28-yr-old resident of Savannah, GA, lacked medical insurance. While working with paint solvent, he was burned over 92% of his body. The physician treating him at Memorial Medical Center in Savannah called "about 30 medical centers around the country in an effort to obtain treatment for him." Finally, he was admitted to the Baltimore City Hospital, when a call from U.S. Representative Gin (D-Ga) to Georgia Governor George Busbee evoked a promise of financial aid.¹¹ In this case, government intervened in an individual case to provide supply. Is this likely to be replicated? Who will stand between demand and supply? Governors? Senators? You?

The problem is a classic one of "tragic choices."¹² When commodities are scarce, two decisions must be made. The first is AVAILABILITY. How much of the resource will be made available? What else must be sacrificed to provide it? Bombers or beds? The second level decision, of ALLOCATION, is much more personal. It need not concern Mr. Lacy's relatives that a reduction in reimbursement has limited availability of burn centers, but when Mr. Lacy is burned, the question is who will get one of those scarce beds and who will make that decision.

Allocation decisions often are emphasized by governments to divert attention away from their own fundamental decisions of availability that, in fact, have evoked the problem but seem more distant. Allocation decisions are traditionally made in 6 ways. A free MARKET was used to allocate service in the armed forces at the beginning of the U.S. Civil War. Soon the supply of men willing to buy their freedom from the draft was exhausted, so this capitation fee was eliminated in favor of the LOTTERY. In a fair lottery, all acknowledge that there

is a shortage of supply and they assume that all will have an equal chance at selection. Is this best for society? Should a shot President Reagan have an equal chance of care with a burned John Lacy?

The POLITICAL allocation is uneven, but explains its rationale. Soldiers must have airplane seats in preference to vacationers. ARESPONSIBLE agencies often are employed to make decisions that are less random than lotteries, less justifiable than political decisions, but presumably serve society better. Aresponsible agencies include juries and draft boards. They are decentralized, representative, and give no reasons. The PARA-ARESPONSIBLE agency is employed most often in medicine. It is a local organization with representation defined. It contains experts as well as sufficient "consumers" to maximize fairness. Continuity is ensured by prolonged service, to make justice uniform if neither rational nor random. Para-aresponsible agencies include Investigational Review Boards that decide the fate of studies of new therapies and "God Committees" that allocate patients to scarce machines.

The sixth allocation mechanism will, I believe, be the one operative in critical care. YOU. YOU will stand in the door, like Cerberus, and direct the supplicants to heaven or to hell. The government and your hospital will limit supply. They will not limit the supplies for the \$396 normal births, the \$1483 inguinal hernias or the \$1936 caesarean sections, but they will limit the supplies for the \$9454 major burn, \$10,024 coronary artery bypass graft, \$9308 injury with craniotomy or \$6602 severely ill premature child.¹³ Imagine tomorrow's suboptimization as each department, each division, each special care unit fights to keep its beds, its piece of the pie. But the pie will shrink, someone will lose, and YOU will allocate those scarce commodities. Will you reject the elderly bank president with chronic lung disease, the young executive with a myocardial infarction, the beautiful prostitute with Pseudomonas endocarditis, or the 850-g newborn son of your department chairman? Who shall be kicked out? How, after days of maximum effort, will you and your staff eject one patient for a newcomer?

The third choice, illustrated previously, is IMPROVED EFFICIENCY. Isn't that a much more desirable option? There are three kinds of efficiency measures. First, there is technical efficiency in which the minimum total input is invested per output unit. Economic efficiency is when the minimum dollar cost per output is achieved. The third efficiency, allocative efficiency, is maximum when there is a "Pareto optimum," when any change will worsen some element. How can we achieve Pareto optimality?

First, we must examine carefully the therapies we espouse. Remember the hyperbaric treatment for stupid old people? In a 1969 article in the *New England Journal of Medicine*, its virtues were extolled, at \$2500 per week, until a 1973 study at New York University proved it

worthless. Remember ptosis surgery for menopause (1890–1928), surgery for constipation (1906–1933), internal mammary ligation (1956–1961), and gastric freezing (1962–1969).^{5, 14} Each new therapy must be examined in a CONTROLLED trial. Controls; placebos. How difficult it must have been for the 8 patients who had sham surgery instead of internal mammary ligation for angina; how great should be their reward for saving countless others.¹⁵ Controlled studies are dangerous to the shibboleths of critical care; no matter how properly we pronounce the words, controlled studies show mobile coronary care of no advantage¹⁶ and home care equally good for uncomplicated myocardial infarction.¹⁷

Second, we must perform not just cost-effectiveness studies, to determine the least expensive way to achieve our ends, but cost-benefit studies, to determine if the ends are worth the investment. We must measure not just discharge from the critical care unit alive, or hospital discharge, but functional capacity 1 month, 1 yr, 1 decade later. Synapses not systoles!^{18, 19}

Third, we must perform our effectiveness studies to examine the MARGINAL BENEFITS. It is not sufficient to estimate that for \$357/day you can save 85% of patients with acute myocardial infarction.¹³ The question is for a marginal increase in effort of \$1/day what will be the payout. Will an additional life cost an extra \$100, or \$10,000, or \$1,000,000?

Fourth, we must perform MULTICLINIC trials to examine outcome. We require large numbers for we are not so much interested in estimating survival probabilities of 50% as we are probabilities of 1% or 0.5%. In Poisson distributions with rare random events, the confidence limits are wide. If no patient in 50 has survived, there is a 5% chance the true survival may be 7% and a 1% chance it may be 10%. If in one kind of illness no patient in 500 has survived, the true incidence will be greater than 1.05% 1% of the time. Because our patients vary in so many ways, we must characterize them carefully, describe their therapy exactly, and measure the outcome functionally in large multiclinic trials. Then, when we must make tragic choices, we can at least be guided by realistic estimates of the relative marginal costs and marginal benefits of extra treatment of a given patient.

Controlled trials that examine outcome appropriately will help us adjust the SUPPLY. Tragic choices will be made more easily with studies to define likelihoods of beneficial therapy. Can we influence DEMAND? Yes. We struggle now to save \$50 million each year by shifting hemodialysis from centers to homes, yet each year in the United States the abuse of alcohol costs us \$60 billion, the abuse of tobacco costs us \$30 billion, and the abuse of motor vehicles costs us 52,000 lives. Speak out. Prevent. Should whiskey bottles be taxed to pay for care of delirium tremens, cirrhosis and automobile accidents? Should pneumonectomies be supported by cigarette

taxes? Should trauma victims who forswear seat belts be assigned lower priorities than those who care?

What traits will critical care practitioners need for our future? Contemporary medical education has emphasized cognitive skills. Is brilliance enough? How can we, even if we were as brilliant as Solomon, sort out the current panoply of positive "rights." Every patient has a right to the best and the most care. Who pays? Do not others have the right to avoid confiscatory taxes? Do physicians and nurses have no rights to their own time? In our profusion of positive rights, we have forgotten two fundamental principles. First, positive rights invariably defeat Pareto optimality. When one component in the system must be accorded a benefit, someone else, something else must suffer. Our resources are finite, yet our current positive rights are infinite. YOU stand at that interface. Your individual patient cries out for his rights to care. Your society cries out for its rights to its own productivity.^{20, 21}

The second principle forgotten today is that rights have traditionally been negative rights. King John Lackland would not seize the property or the wives of his nobles without due process. King George should not tax without representation. We should not discriminate systematically in providing scarce medical resources on the basis of race, creed, sex, etc.

I suggest we go back in philosophy before positive rights, before negative rights, to Aristotle. Aristotelian aretai are the natural skills needed in life such as courage and justice. They are character traits. The key virtue is *phronesis*, the master characteristic that unifies the other aretai. With sufficient aretai, and especially *phronesis*, the individual and the society may achieve eudaimonia, perhaps an early definition of Pareto optimality. The important aspects of Aristotelian character traits or virtues are that they are learned, taught, and practiced. We can teach them. We can model ourselves as we would want our peers and students to become. The virtues must be practiced every day, in every way. One cannot have a lack of wisdom, or a lack of honesty, or a lack of courage—virtues must harmonize to achieve eudaimonia. Everyone cannot have all positive rights, but everyone can share perfect eudaimonia by developing, nurturing, and practicing aretai and *phronesis*. Tomorrow our resources will be lessened, the demand for them will be increased, but by emphasizing *CRITICAL CARE PHRONESIS* you will be able to provide optimal care.

*Considerate la vostra semenza:
Fatti non foste a viver come bruti,
Ma per seguir virtute e canoscenza.*

(Consider your origins:
you were not made that you might live as brutes,
but so as to follow virtue and knowledge.)
Dante: *Divina Commedia, Inferno*, xxvi, 118.

REFERENCES

1. Health Care Financing Administration, Department of Health and Human Services
2. Freeland M, Calat G, Schendler CE: Projections of national health expenditures, 1980, 1985, and 1990. *Health Care Financing Review* 1980; 1
3. American Hospital Association Guide, 1981 Ed, 1981
4. Hospital Statistics, 1978. American Hospital Association, 1979 cited in Reference 5
5. Eastaugh SR: Medical Economics and Health Finance. Boston, Auburn House Publishing Company, 1981
6. Gibson RM: National Health Expenditures, 1979. *Health Care Financing Review*, 1980
7. Handbook of Basic Economic Statistics. *Economic Statistics Bureau* 1980; 24:5
8. Profile of Medical Practice. Center for Health Services Research and Development, American Medical Association, 1980
9. Statistical Abstract of the United States. U.S. Department of Commerce, Bureau of the Census, 1980
10. Annual Survey of Hospitals, 1976-1980, American Hospital Association
11. Associated Press, May 8, 1982
12. Calabresi G, Bobbitt P: *Tragic Choices*. New York, WW Norton & Co, 1978
13. Bentley JD, Butler PW: The DRG case mix of a sample of teaching hospitals: a technical report. Association of American Medical Colleges, 1981
14. Barnes B: Discarded operations: surgical innovation by trial and error. In: *Costs, Risks, and Benefits of Surgery*. Bunker J, Barnes B, Mosteller F (Eds). New York, Oxford University Press, 1977
15. Neuhauser D: The public voice and the nation's health. *Milbank Memorial Fund Quarterly* 1979; 57:60
16. Hampton J, Nicholas C: Randomized trial of mobile coronary care units for emergency calls. *Br Med J* 1978; 1:1118
17. Hill J, Hampton J, Mitchell J: A randomized trial of home versus hospital management for patients with suspected myocardial infarction. *Lancet* 1978; 1:837
18. Pence GE: *Ethical Options in Medicine*. Oradell, NJ, Medical Economics Co, 1980
19. Graham LR: *Between Science and Values*. New York, Columbia Univ. Press, 1981
20. Robbins DA, Dyer AR: *Ethical Dimensions of Clinical Medicine*. Springfield, IL, Charles C Thomas, 1981
21. Veatch RM: *A Theory of Medical Ethics*. New York, Basic Books, 1981