

Introduction:

A Time to Measure

Myron B. Laver, M.D.

Editor for the Issue

MONITORING of biological function in the sick is now a way of life. The need for measurement while guiding therapy has reached the status of unquestionable virtue, and the challenge before us is for more, not less, sophistication. As readers of our Symposium will discover, the end is nowhere in sight. What we once considered appropriate for the academic environment has now become mundane, a mandatory maneuver if we are to navigate the ill through their complex physiologic and biochemical perturbations. Fortunately or not, the mind appears far from limited in its exploration of body function. Now we stand on the threshold of more exciting things. Noninvasive techniques, utilizing radioisotopes in minimal quantities with advanced sensor and computer technology, promise a new era for analysis of myocardial performance. We are no longer limited to recording of heart sounds and electrical activity; in the next generation it will be possible to follow beat-by-beat changes in both right and left ventricular chamber size and ultimately, the distribution of blood flow within heart muscle. Reading the article by Wexler and Pohost¹ with only a slight extension of the imagination, one can envision the quality of information potentially available with instrumentation now used for diagnosis of organic disease. Kessler *et al.*² proceed a step further. Theirs is the art of the minutiae made into everyday reality: biochemical monitoring at tissue level. Can it ever end? Considering our potential for engineering sophistication, not likely. Yet, the pace toward better detection may find itself broken by the shrinking

assets of our planet. Despite the promise of unimaginable benefit, we will have to face the dilemma between continued pressures for more expensive science and the virtues associated with the desire to eradicate disease. It is easy to look at past performance and argue that unfettered science will provide all the answers; only the individual intent upon academic suicide will argue the contrary, yet the need to explain how such a program is to be budgeted cannot be avoided. Let us look at the numbers.

First, the growth of patient care costs within the context of our changing economy is best appreciated if the budgetary growth of a 1,000-bed hospital dedicated to the best of care for the critically ill is compared with that of a corporate giant (see fig. 1). Although the scales differ by a factor of 100, the rates of growth are parallel and do not show a plateau. Since the yearly health care inflation between 1970 and 1975 has continued at 6 to 8 per cent per year, with no end in sight, the effect on future supply and demand for money is, to say the least, thought-provoking. Although industrial genius is likely to find its way to reduce per unit price of monitoring equipment, no amount of research appears capable of reducing health care cost. Given the continuing advance and potential for improvement, can our society afford "life forever"? If the birth rate continues to decline and the world grows progressively older, we may find that a reduction in crime will result from the fact that the aged are too debilitated to be criminal and the remaining young too busy gathering equity to support the retired sick!

There are many reasons why hospital life is expensive. Health care delivery requires a growing complexity of qualified personnel to attend upon the patients' needs. Wages are up and the number of daily non-labor inputs, including expendable supplies and equip-

Received from the Anesthesia Laboratories of the Harvard Medical School at Massachusetts General Hospital, Boston, Massachusetts 02114.

Address reprint requests to Dr. Laver: Department of Anesthesia, Massachusetts General Hospital, Boston, Ma 02114.

ment, is increasing. Unlike the corporate giant, the hospital does not sell goods, cannot entertain the thought of a price war, cannot cut services because it is losing money, and cannot replace physicians or nurses with computers, probably because the latter have not learned to smile.

According to a survey by Feldstein,² the average hospital cost per patient day has risen nearly twice as much during the past decade as the average annual earning. If we continue to argue for greater sophistication of care and more skilled personnel, then our hospitals will set the pace with an unprecedented inflation rate.

Compare also the growth in health care costs with our gross national product (GNP) (fig. 2). The 7 per cent of GNP spent on health care today projects to a healthy 13 per cent by the year 2000 if the rise continues unabated. Who can tell us where this money will come from?

Resolution of the dilemma will not be easy.

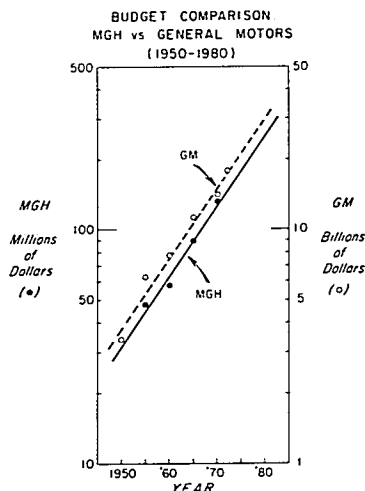


FIG. 1. Comparison of gross budget trends for a 1,000-bed hospital (MGH) and General Motors. Projection of the hospital budget from 1960 to 1980 predicts a rise in the yearly budget from 60 to approximately 250 million.

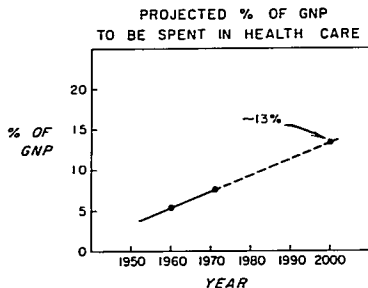


FIG. 2. The projected cost of health care in the United States for the year 2000 as per cent of the gross national product (GNP) if the present trend continues unabated.

During a discussion of the potential effects of national health insurance on graduate medical education, R. J. Blendon indicated that health professionals can relate intellectually to discussions about the severity of inflation but at heart, most are unsympathetic to the issue: "Expenditures for the Disneylands, the yearly changes in automobile styles, and the billion dollar cosmetic industry make it very difficult for most health professionals to believe that Americans cannot afford the renal-dialysis unit, the arthritis research lab, or an extra day in the hospital." It would take less than the services of a talented mathematician to realize the potential economic burden on our social services were we to prolong life by another fifty years! Unfortunately, our ability to plan social progress lags behind our capacity for understanding disease.

The final argument is generated by data from the study by Cullen *et al.*³ on the economics of caring for the critically ill. The numbers presented by these authors are sobering, and substantiate what we have all known: reduction of mortality from degenerative disorders to less than 5 per cent is associated with a massive and perhaps unaffordable increase in hospital care cost.

These arguments are not intended to imply that we wish to eradicate research or abandon the sick. Nothing of the sort. The conscientious physician must continue to set his will and knowledge against the forces that result in biologic deterioration. On the other hand,

TABLE 1. Components of Hospital Cost Inflation*

| | 1955 | 1960 | 1963 | 1966 | 1968 | Per Cent Change 1955-68 |
|--|-------|-------|-------|-------|-------|-------------------------------|
| 1) Average cost per patient day (\$) | 23.12 | 32.23 | 38.91 | 48.15 | 61.38 | 165.5 |
| 2) Labor cost per patient day (\$) | 14.26 | 20.08 | 24.01 | 29.41 | 36.61 | 156.7 |
| 3) Personnel cost per patient day (\$) | 2.03 | 2.26 | 2.41 | 2.61 | 2.72 | 34.0 |
| 4) Average annual earnings (\$) | 2,563 | 3,240 | 3,639 | 4,097 | 4,918 | 91.9 |

* Reproduced with permission from Feldstein MS: The rising cost of hospital care, Washington, D.C., Information Resources Press, 1971.

being aware of the economic implications does not jade the loftiness of our ideals. Monitoring means to measure and to follow, above all, with judgement. Implicit in the term is the awareness to forestall trouble. Unfortunately, threat of litigation has clouded the issue at a substantial increase in cost. Data collection appears as another form of bedside insurance rather than a modality for fresh interpretation of results.

Awareness of the economic problem will allow us to tame the monster. As the Symposium indicates, monitoring systems are designed to tell us how to move ahead, but seldom when to quit.

References

1. Wexler LF, Pohost GM: Hemodynamic monitoring: Noninvasive techniques. *ANESTHESIOLOGY* 45:156-183, 1976
2. Kessler M, Höper J, Krumme BA: Monitoring of tissue perfusion and cellular function. *ANESTHESIOLOGY* 45:184-197, 1976
3. Feldstein MS: The Rising Cost of Hospital Care. Washington, D.C., Information Resources Press, 1971
4. Blendon RJ: Potential effects of national health insurance on graduate medical education. *Clin Res* 20:685-699, 1972
5. Cullen DJ, Ferrara LC, Briggs BA, et al: Survival, hospitalization charges and follow-up results in critically ill patients. *New Engl J Med* 294:982-987, 1976