Articles

Some of the Tough Decisions Required by a National Health Plan

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The goals of providing coverage for everyone in the United States and controlling the growth in national health expenditures require difficult decisions about what medical services to provide. Currently accepted practices vary enormously in the amount of health they produce for a given expenditure. Studies of the health effects of several major interventions in relation to their costs—Pap smears, mammography, coronary care units, bypass surgery, and cholesterol reduction—indicate the kinds of choices to be made.

AFTER ALMOST A DECADE, NATIONAL HEALTH PLANS ARE back on the agenda. Three major proposals have already been made public this year (*1–3*). Although the plans are different in detail, their authors are motivated by a common set of problems and agree on a common set of goals. The principal problems are that the current U.S. system is very expensive, but, at the same, it leaves many of the most vulnerable people unprotected against the costs of serious illness. Approximately 35 million people, many of them poor, have no health insurance, and millions more have insurance that is considered inadequate. This situation exists despite the fact that the United States spends more on medical care than any other industrialized nation—$500 billion in 1987, 11% of the gross national product.

It is argued in these proposals that the time has come for a national health plan that covers everyone and brings the growth in expenditures under control. These goals are not new, nor is the criticism that money is not well spent under the current system. What is new is the recognition that meeting these goals will require difficult decisions about what to provide, to whom, and under what circumstances. The proposals call for a greatly expanded effort to evaluate the effectiveness and costs of medical care in order to get the most value for the money spent. "Until we can better define quality and appropriate care," states the National Leadership Commission on Health Care, a group of citizens concerned about health policy, "we cannot really know what is worth providing access to and what is worth paying for" (*1*, p. 3); the commission recommends earmarking part of premium receipts for research (*1*). Commenting on the commission's plan, Arnold Relman, editor of the *New England Journal of Medicine*, writes, "Information about results and relative benefits is a prerequisite for intelligent choices" (*4*).

In this article, I discuss the nature of the decisions that must be made, describe the economic concepts and methods available for making informed decisions (especially cost-effectiveness analysis), and present illustrative choices based on cost-effectiveness studies of current medical issues.

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Opportunity Cost and Cost-Effectiveness Analysis

If decisions about medical care are to be made well, alternative ways of using resources must be compared. "Opportunity cost" is the central economic concept in making such comparisons. An example will help define the term.

Suppose that a community's board of health has $300,000 to spend on a new health program and three possible programs on which to spend it. The programs are mutually exclusive and each will use the full $300,000—it is not possible to do a little of all of them. Program A will save 100 years of life, program B 10 years, and program C 1 year. Thus the cost per year of life saved is $3,000 for program A, $30,000 for program B, and $300,000 for program C. In each case the estimates of lifesaving are based on impeccable scientific evidence; there is no doubt that the programs are effective and that they will have the effect estimated. As will be evident later, real and respectable medical interventions vary as much in their cost per year of life saved as do these hypothetical programs.

If the object is to improve health as much as possible with the money, the choice seems obvious—program A, which will save 100 years of life. If program B is chosen, only 10 years will be saved with the same money, and the 100 years that could have been saved with A will be lost. Thus the opportunity cost of choosing program B is the loss of the opportunity to do program A and of the 100 years it could save. More generally, the opportunity cost of using resources in one way is the loss of the benefits they could have achieved had they been put to their next best use. By contrast, the opportunity cost of program A is much lower—the 10 years of life that would be saved if the money were spent instead on progam B.

It is desirable to keep the opportunity cost of our choices as low as possible. Although the choice that does so is obvious in the example, choices in real life are usually more difficult. First, better health is an important objective, but not the only one, and more objectives make it more difficult to decide which alternative is best. Second, it is harder to give up real opportunities, even for better ones, than hypothetical opportunities. Third, and of critical importance, it is often not easy to determine the true opportunity cost of a decision.

Cost-effectiveness analysis is used to evaluate the opportunity costs of decisions in medical care (as well as many other fields). It comprises principles and methods for estimating the resource costs and the health effects of alternative medical interventions, for

answering the questions, "How much does each intervention cost?" and "How much health does it produce?" The answers are comparative—the costs and health effects of one intervention must be compared with another (*5*).

The costs of an intervention include the costs of all the medical services required to produce the expected health benefit. These can be laboratory tests, physician visits, hospital care, surgery, rehabilitation therapy, or other medical services. If the intervention produces side effects, the costs of treating them must be added. Some interventions, such as vaccinations, may reduce or eliminate the need for medical services later by preventing illness; the savings are subtracted from the cost of providing the service. The net costs associated with an intervention—its costs less any savings—may be paid out over a period of years, depending on the condition being treated and the nature of the treatment.

The health effects of an intervention are often measured in terms of years of life saved, as in the example. More precisely, they consist of the years saved minus any years lost to side effects—the net health effects. Health effects often extend over many years, as when a child whose life is saved lives to old age. In addition, they may not be realized immediately—the gains from controlling high blood pressure are the strokes and heart attacks prevented years later.

Years of life saved is a simple measure, important and relatively easy to estimate, but medical care does much more than extend lives. It alleviates pain, repairs or prevents disability, and soothes (or causes) anxiety. Methods have been developed to quantify these outcomes (*6*). In essence, these methods assume that people can say what fraction of a year of good health is equivalent to a year with some condition or set of symptoms—for example, a year with stiffness of the neck or hands might be valued at 0.95 of a perfectly healthy year. Such valuations make it possible to measure health improvements in terms of years (called healthy years, well years, or quality-adjusted years), even when the improvements do not extend life. An intervention that relieved the stiffness would be credited with a gain of 0.05 healthy years for each year of relief. If the improvement affected 20 people for 10 years each, the gain, expressed in healthy years of life, would be 10 years ($20 \times 10 \times 0.05$). When health effects are expressed this way, the outcomes of interventions that improve health without saving lives can be compared with those that do. Also, different effects of the same intervention—say, pain relief and longer life—can be expressed in this common unit and added together.

The methods allow interventions that extend lives of different quality, or that produce health improvements of different magnitudes, to be compared. Suppose that people value a year of life subject to severe disabilities at 0.2 of a healthy year. An intervention that extended life under such circumstances would be credited with only 0.2 of a healthy year for each calendar year of life gained, whereas an intervention that extended the lives of healthy people would be credited with one healthy year for each calendar year. An intervention that cured the disabilities of a severely disabled person would receive credit for 0.8 of a healthy year ($1.0 - 0.2$) for each year of cure. Although these methods have been validated in several studies (*7*), they are not widely used. Only one study cited in this article makes use of them (*8, 9*).

Simply adding costs or health effects to arrive at a total implies that future costs and effects are valued as highly as present ones. The usual practice is to discount future costs and effects to reflect the assumption that they are less valuable than present ones. Costs (which represent resources) and health available now can be invested to yield returns in the future. Further, we generally prefer to have things now rather than later, so that we value present things more highly than future ones for this reason as well. When future costs or health effects are discounted and added to current ones, the sum is the total "present value," that is, the total value of those costs or health effects today. Except where noted, the results reported here use the discount rate of 5% for both costs and health effects.

Cost-Effectiveness Results

Cancer screening. In recent years considerable debate has focused on the best schedule for cancer screening tests. Yearly tests seem natural because so much is done on an annual cycle, but how do the costs and health effects of annual and less frequent screening compare?

Consider the Papanicolaou (Pap) smear, a safe and effective test for invasive cervical cancer and its precursors, dysplasia and carcinoma in situ. Eddy has estimated that if all women begin testing at age 20 and continue until age 75, the cost per year of life saved by testing every 3 years, compared with no screening, is about $13,300 (Table 1, 1985 dollars) (*10*). If the frequency of the test is increased to every 2 years, the cost per year of life saved rises to $419,800. Testing every year costs more than $1 million per life-year. Screen-

Table 1. Cost per year of life saved: original estimates and adjusted to 1986 dollars. The medical care component of the Consumer Price Index was used to adjust the numbers from the original studies to 1986 dollars.

Medical intervention	Cost in dollars at year of study		Cost adjusted to 1986 dollars	Reference
Pap smear				
Every 3 years	13,300	1985	14,300	(*10*)
Every 2 years	419,800		451,200	
Every year	1,064,300		1,144,000	
Mammography				
40–50: physical exam only	33,000	1985	35,500	(*13*)
mammography added	134,100		144,100	
55–65: physical exam only	15,500		16,700	
mammography added	83,800		90,100	
Coronary care units				
5% risk	139,000	1980	226,400	(*14*)
10% risk	66,000		107,500	
20% risk	33,000		53,800	
Bypass surgery				
Left main disease	3,800	1981	5,600	(*8*)
Three-vessel disease	7,200		10,600	
Two-vessel disease	17,500		25,800	
One-vessel disease	30,000		44,100	
Cholesterol reduction*				
40, 240, low risk	180,000	1986	180,000	(*19*)
40, 240, high risk	21,000		21,000	
40, 300, low risk	94,000		94,000	
40, 300, high risk	11,000		11,000	
60, 240, low risk	280,000		280,000	
60, 240, high risk	23,000		23,000	
60, 300, low risk	160,000		160,000	
60, 300, high risk	13,000		13,000	

*The first number is the man's age, the second is his total serum cholesterol level, and "low risk" or "high risk" summarizes his other risk factors for heart disease.

ing every 2 years is compared with screening at 3-year intervals, so that the figure shows the additional cost because screening is done every 2 years, divided by the additional years of life saved as a result of the more frequent screening. The number for annual screening shows the additional cost per additional year compared with screening every 2 years. The schedules differ enormously in the cost per year of life saved, and the administrators of a national health plan might well ask whether annual testing is a good use of resources, or whether the resources could produce more health if they were used somewhere else.

Although the cost assumed in this analysis is only $75 per woman (for the test and the doctor's visit), the costs per life-year for all three schedules are in the tens of thousands of dollars for reasons that apply to screening programs generally. First, the test must be applied to millions of women, most of whom do not have, and will never have, cervical cancer, and it must be repeated at the specified interval. When disease is discovered, further tests must be done, and if the condition is confirmed, treatment undertaken. Treatment costs are correctly included in the cost of the screening program because without them there would be no health benefit; there is no value in knowing a woman has dysplasia or cervical cancer unless something is done about it. The total cost comes to billions of dollars annually and only a small portion is offset by savings from treating disease at an earlier stage. Because many women never get the disease and thus never benefit from screening, these costs must be compared with the years of life gained by the small number who do benefit.

These factors do not explain why the cost per year of life rises so steeply for more frequent screening. The reason is that, because of the natural history of cervical cancer, screening every 3 years captures more than 95 percent of the health benefit produced by annual screening (*11*). Cervical cancer develops slowly and is usually preceded for some years by dysplasia or carcinoma in situ, or both (although these conditions do not always progress to invasive cancer), conditions that are easily treated and have a high rate of cure. The small additional health benefit from screening annually requires tripling the total cost of screening, hence the much higher cost per year of life saved.

Another way to try to capture most of the benefits of screening at lower cost is to separate people into high- and low-risk groups, and screen only the high-risk people. Since the incidence of many diseases rises as people grow older, age is one way to sort people by risk. The best age to begin screening depends not only on incidence, but on such factors as the effectiveness of the test at different ages.

Mammography provides a case in point. Mammography is an effective test for breast cancer in women over 50 years of age and is recommended annually for these women. The evidence from clinical trials has not yet demonstrated conclusively that it is effective for women under age 50, who are less likely to develop breast cancer (*12*). The longest running clinical trial of mammography has begun to show an effect for the younger group, although other controlled trials have found no benefit. On the assumption that the first trial eventually proves correct, Eddy has calculated the cost per year of life saved if annual screening begins at age 40 instead of age 50 (*13*). For women between the ages of 40 and 50, annual physical exams cost $33,000 per year of life (Table 1, 1985 dollars). When mammography is added to the physical exam, the additional cost per additional year of life is $134,100. The comparable figures for women aged 55 to 65 are $15,500 and $83,800, respectively.

It costs less per year of life saved to screen older women, whether by physical exam alone or by physical exam and mammography. The differences between groups are not, however, so large that mammography is clearly right for one but not the other. Once again, the decision must depend on the resources available and the opportunity costs of using them for mammography rather than something else.

Coronary care units and bypass surgery. The cause of chest pain, a common symptom of myocardial infarction, can be difficult to diagnose conclusively. Many patients with chest pain are routinely admitted to coronary care units as a precautionary measure, even though their other symptoms suggest that the probability of myocardial infarction is low (*14*). In the unit they are monitored intensively to establish a final diagnosis and to watch for problems that require rapid correction. In order to prevent or treat abnormal heart rhythms, some of which can be lethal, intravenous drugs can be administered continuously. As many as 70% of patients in some coronary care units are of this type; they are there to "rule out" the possibility of an infarct.

Fineberg, Scadden, and Goldman calculated the cost per year of life saved by admitting these low-risk patients to coronary care units rather than to less expensive intermediate care units (*14*). (An intermediate care unit offers the same services with fewer nurses, so that nursing care is not as intensive.) Goldman *et al.* had previously developed a screening system to identify the patient's risk of having a heart attack on the basis of symptoms at the time of admission to the hospital (*15*). In a test, the screening system predicted that about one-third of 241 patients admitted to the study's coronary care units were at very low risk of a heart attack; the prediction was confirmed when less than 5% of these patients ultimately proved to have myocardial infarctions. Fineberg and his colleagues calculated that the cost per year saved was $139,000 for patients with only a 5% risk of a true myocardial infarction, $66,000 for patients with a 10% risk, and $33,000 for those with a 20% risk (Table 1, 1980 dollars). Future health benefits were not discounted in this study (*16*). If they had been, the cost per year of life would be considerably higher; this should be kept in mind when comparing these estimates with others presented in this article.

Not all inpatient hospital care is as expensive as it looks once its health effects are taken into account. Coronary bypass graft surgery, for example, is a costly operation—between $15,000 and $20,000 in 1981. But for a middle-aged man with a diseased left main coronary artery the procedure is so effective that the cost per year of life saved, compared with medical treatment of the condition, is low, about $3,800 in 1981 dollars (Table 1) (*8*). The cost per year of life rises for those with less serious conditions—to $7,200 per year for men with three diseased vessels (none the left main artery), $17,500 for those with two-vessel disease, and $30,000 for those with one-vessel disease. The estimates apply only to men with symptoms, not those with silent disease, and exclude the costs of diagnostic tests such as coronary angiography. This study counts improvements in health as well as longer life in its calculations of years gained. These improvements, in particular relief from the pain of angina pectoris, account for the effectiveness of bypass surgery in men with one-vessel disease; the evidence available at the time did not show that surgery extended their lives.

Cholesterol reduction. In the 1970s, after publication of evidence that drugs to lower blood pressure saved lives, screening and treatment for high blood pressure became standard procedure with the medical profession. Much the same thing seems to be happening in the 1980s for high blood cholesterol (*17*). Clinical trials have shown that, in middle-aged men with elevated levels, reducing cholesterol reduces deaths from heart disease. A panel convened by the National Institutes of Health has published treatment guidelines recommending dietary change for many adults, and drugs for high-risk people if diet is not enough. To continue the panel's work, NIH sponsored an educational program, similar to its program for high blood pressure, to disseminate the recommendations to practitioners and the public (*18*).

Taylor and his colleagues have estimated the costs and health effects for middle-aged men of a program of dietary change similar

to the one used in a major clinical trial, the Multiple Risk Factor Intervention Trial (MRFIT) (*19*). Each man is assumed to have an initial cholesterol test at a visit to the doctor for some other reason. If the test shows an elevated level, he is retested and further tests are undertaken to rule out the possibility that previously undetected disease is the cause. The necessary changes in diet are explained and reinforced during ten visits with a registered dietitian in the first year, and three in each subsequent year. He returns to the doctor twice the first year, once each following year, and has his cholesterol retested regularly. The costs of this regimen are $557 per person the first year and $150 in each of the following years.

On the basis of evidence from a long-term study of heart disease in Framingham, Massachusetts, it is thought that the benefit from reducing cholesterol is higher for people who have other characteristics that make them susceptible to heart disease—high blood pressure, cigarette smoking, and a low level of high-density lipoprotein (HDL) cholesterol, a component of cholesterol. Taylor and his colleagues estimated the cost per year of life saved for men at high and low risk. Because the data from the Framingham study suggest that cholesterol is no longer associated with heart disease deaths once men reach 65, the investigators assumed that the regimen was discontinued at this age.

The cost per year of life saved is shown for sample cases in Table 1. A low-risk man is one who does not smoke and has low blood pressure and a high level of HDL. A high-risk man smokes and has high blood pressure and low HDL (*20*). The cost per year of life is much lower for the high-risk man in every case. Estimates were made for other regimens as well—a less expensive dietary program and regimens that include drugs. Although the costs per life-year are different for these options, the gap between low-risk and high-risk men remains—it is much less costly to treat high-risk men.

The estimates are based on the assumption that the reduction in deaths from heart disease that has followed cholesterol reduction in a number of clinical trials will eventually produce a reduction in deaths from all causes. With one possible exception, the trials have not yet shown this (*21*). Instead, fewer heart disease deaths have been offset by more deaths from other causes, leaving the overall death rate unchanged (*17*). Benefit for groups other than middle-aged men has also not been conclusively shown: the Office of Technology Assessment recommended against offering cholesterol screening through Medicare because the evidence does not show that cholesterol reduction is beneficial for people over 65 (*22*).

Caveats

Cost-effectiveness studies of medical interventions are only as good as the evidence of effectiveness on which they are based. This evidence comes from clinical trials, epidemiological studies, and the opinions of experts in the field. To a greater degree than is generally recognized, the evidence for many interventions is incomplete, subject to different interpretations, and, in some cases, contradictory (*23*). Not all of it is of good scientific quality, and Feinstein argues that this is particularly true of epidemiological studies of chronic disease (*24*). The quality of the evidence is as much a problem for decisions made on purely medical grounds as for cost-effectiveness analysis. In fact, cost-effectiveness analysis has an advantage over traditional medical decision-making, which does not use formal modeling techniques, because assumptions and methods are explicitly stated and the effects of alternative assumptions routinely tested. But in making cost-effectiveness assessments, or purely medical decisions, it is important to remember that we are working with incomplete information and to be appropriately cautious in our judgments (*25*).

Accurate assessment of opportunity costs requires that evaluations of alternatives differ only in those respects that reflect their costs and health effects, not in arbitrary choices of discount rate, costs to include, and the like. Even the carefully chosen studies cited here are not as alike as they could be. The study of coronary care units did not discount future health effects, whereas the other studies did, and in some of the studies locally available cost information was used, so that the estimates may be not representative of the nation (*26*). An expanded research effort to evaluate the costs and health effects of medical services would need to stress comparability to ensure that the results allow the necessary judgments to be made. An agenda for improving the comparability of cost-effectiveness studies has been offered elsewhere (*5*).

The studies presented here examine the costs and health effects of a medical intervention over the lifetime of an individual or group of individuals. This is an appropriate way to evaluate an intervention, but does not show the costs a national health plan would incur each year to provide it. The kind of estimate needed for this purpose is presented by Eddy (*13*).

Decisions for a National Health Plan

The examples presented here indicate that decisions about effective interventions typically concern how much of each service to provide, not simply whether to provide it. Should Pap smears be recommended annually or every 3 years? Should intensive coronary care be provided to all comers or only some? In an ideal world, all effective interventions would be provided to anyone who could benefit, but, in the real world, limited resources force choices. The importance and difficulty of the choices underscore the need for careful analyses and more of them. Current evaluation efforts are not sufficient to address all, or even most, of the important issues. Future research should rest on a foundation that ensures that it is not only careful but comparable and subjected to periodic reevaluation as new medical services become available and existing ones improve.

Who will use the results of the research? Nothing about cost-effectiveness analysis dictates that decisions be made at the national level. A national health plan could control costs primarily through the level of resources it makes available, much like the Canadian system (*27*) or Medicare's prospective payment system for hospitals (*28*). Faced with constraints on resources, practitioners have always made their own decisions about what to provide and when (*29*), although often rather haphazardly (*30*). Cost-effectiveness studies provide guidance that could lead to better decisions. Insurers and professional societies have already begun considering cost-effectiveness results when designing practice guidelines (*31*).

Cost-effectiveness studies do not replace human judgment. Even if a certain use of health dollars produces the most health for the money, there will be times when considerations of fairness, or of some other social goal, suggest another choice. For example, it is more difficult to produce good health in rural areas, where people are far apart and services more expensive to deliver, but fairness dictates that rural populations receive a reasonable level of service. As another example, a national health plan would start from an already established pattern of services and would almost certainly choose to make changes slowly to allow time for adjustment.

Ultimately, the services included in a national health plan depend on the resources available, on the alternatives for the use of those resources (opportunity costs), and on people's judgments about the value of the alternatives. Cost-effectiveness evaluations make the alternatives clearer and can help ensure that our choices more truly reflect what we care about.

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31. The studies by Eddy of screening for cervical and breast cancer were used by the Blue Cross/Blue Shield National Association and the American College of Physicians as the basis for recommendations to their members.

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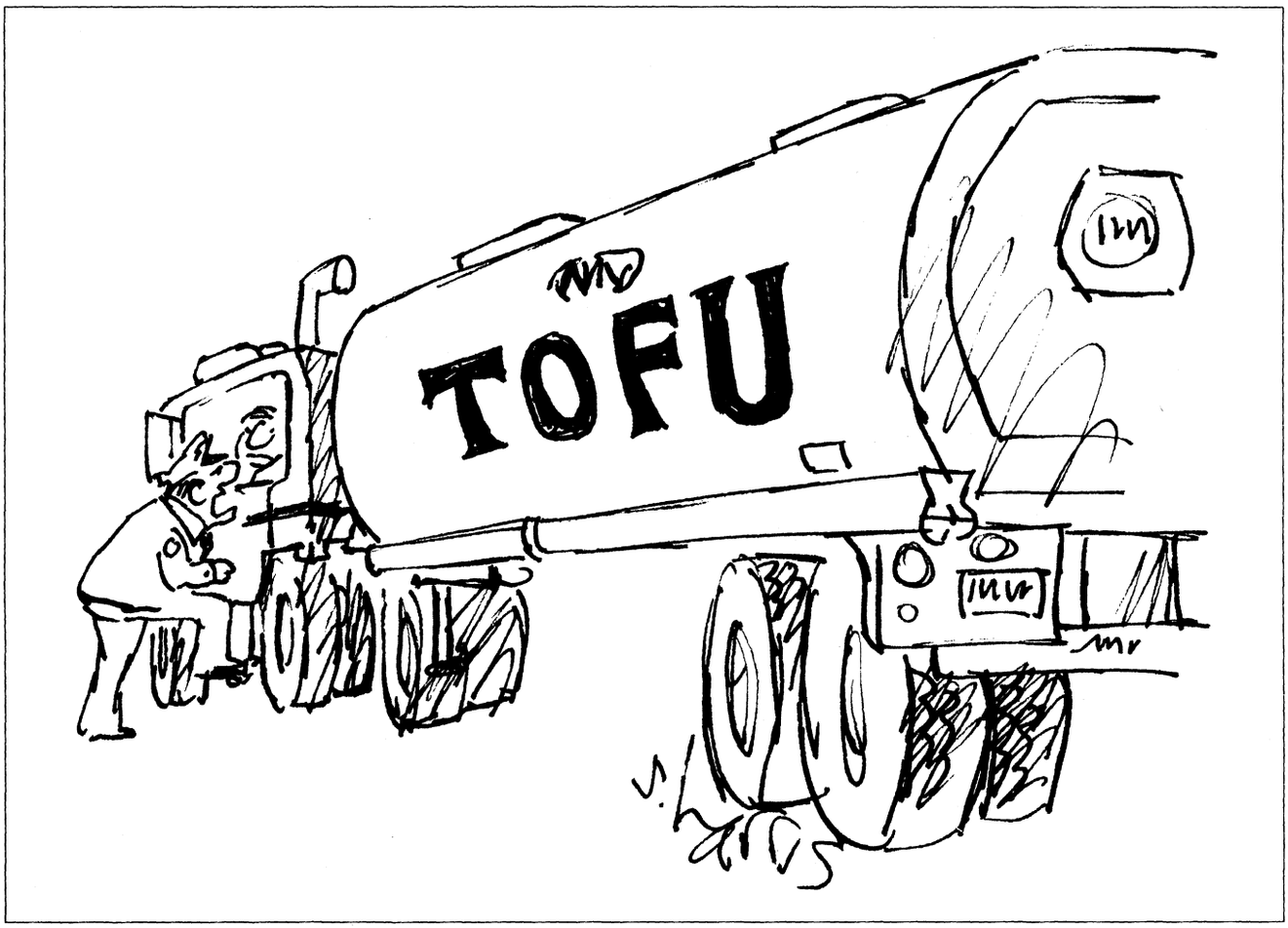

" All right – where's the nutrition crisis?"