High-Priced Technology Can Be Good Value for Money

Medical technology is now subject to the same economic scrutiny that was historically reserved for public health and disease prevention programs. It has long been true that vaccination, health education, and screening programs have been required by both public and private health care agencies to prove their economic worth before they could be funded. A frequently encountered criterion for funding of prevention programs is that they must save more money than they spend—the test of "cost savings" (1) or, in a term heard in government circles these days, *budget neutrality*. As pointed out by Russell (2) and others (3, 4), it is unrealistic to expect disease prevention programs, in general, to be budget neutral. Most preventive efforts cost more money than they save, even those as beneficial as vaccination to prevent pneumococcal pneumonia in elderly persons (5); treatment for high blood pressure (6); and screening for breast, colon, and cervical cancer (7–9).

The appropriate criterion for funding of preventive medicine and public health is not cost savings, but acceptable value for money. A program's cost-effectiveness ratio is a measure of just that: How much does it cost to purchase a gain in health outcome? Unfortunately, there is no clear standard for what constitutes good value for money. Cost-effectiveness ratios are often placed in context by comparisons with interventions that are widely mandated, such as annual screening mammography for women 55 to 65 years of age at $20 000 to $90 000 per life-year gained (7) or hemodialysis for end-stage renal disease at $60 000 to $128 000 per quality-adjusted life-year (QALY) (10). No consensus defines the cost per QALY that represents acceptable value for money (11). The implicit and explicit decisions of patients, physicians, insurers, employers, and government agencies and legislators make it clear that Americans are willing to spend money to get better health outcomes, even though the amount that they are willing to spend on health care is not unlimited.

What a difference a decade makes! In the good old days, when prevention was subjected to the critical eye of economic evaluation, high-technology clinical medicine escaped this kind of scrutiny. Medical care, after all, was "free" because somebody else paid for it. Now, with price competition among health care plans and provider groups in the United States, the test of budget neutrality is starting to be used to restrict the flow of costly yet beneficial new medical technologies—or at least technologies without a well-organized constituency or a dramatically visible life-saving effect. Economic evaluation these days often takes the form of "cost minimization" analysis (how much money can be saved?), rather than cost-effectiveness analysis (how much health improvement can be gained, dollar for dollar?). When true cost-effectiveness analyses are done, they are often greeted with hostility and skepticism because they are seen as tools for saving money rather than as guides to improving health outcomes at reasonable cost. In reality, failure to heed the findings of cost-effectiveness analyses can lead to lost opportunities to extend life and improve health.

In this issue, two cost-effectiveness studies clearly demonstrate that these cost-increasing technologies do indeed represent good value for money in the clinical uses for which they were evaluated. In the absence of careful analyses, the barrier imposed by the cost of these technologies—$500 per patient for transesophageal echocardiography (TEE) (12) and $236 more per patient for initial treatment with low-molecular-weight heparin (LMWH) than with unfractionated heparin in persons with acute deep venous thrombosis (13)—could deter cost-conscious institutions from providing them. Yet careful analysis showed that both treatments represented good value for money.

Consider first the use of TEE to detect patients with endocarditis who could benefit from long-course antibiotic therapy. Rosen and colleagues (12) compared this test-and-treat strategy with both the strategy of giving long-course therapy to every patient and the strategy of giving short-course therapy to every patient despite the increased risk for complications. Assuming that TEE had a true-positive fraction (that is, test sensitivity) of 96% for detecting endocarditis, the authors estimated a gain in quality-adjusted life expectancy of more than 1 year

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for every 22 patients tested (0.045 QALYs per patient) when the TEE strategy was used instead of short-course antibiotic therapy in all patients. After the offsetting costs associated with lower complication rates in patients identified and treated with long-course antibiotic therapy and the added cost of long-course therapy are accounted for, the net cost per additional QALY gained was estimated at less than $5000—far below the cost per QALY for many accepted clinical practices (14). In response to the suggestion that all patients should receive long-course antibiotic therapy to save the cost of the $500 diagnostic test, the analysis estimates that only 0.88 quality-adjusted days per patient could be gained by avoiding the false-negative results on TEE and that the additional cost of this gain ($1.7 million per QALY) would not be good value for money. Like any good cost-effectiveness analysis, this one provides sensitivity analyses for the prevalence of endocarditis, the sensitivity of TEE, the probability for relapse of infection, and the unit costs of tests and treatments. It also shows that the cost-effective niche of the TEE strategy is secure: Its incremental cost-effectiveness ratio is less than $20 000 per QALY compared with short-course therapy for all patients, and the incremental cost of the long-course treatment strategy exceeds $100 000 per QALY under all plausible assumptions.

The second cost-effectiveness study in this issue (13) concerns the use of LMWH to treat acute deep venous thrombosis. At a cost premium of $236 for the initial course of treatment, patients experienced reduced risk for early major bleeding complications, recurrent deep venous thrombosis, and death. The incremental gains may seem small, but the reduction in death from 6.7% to 5.1% is similar to the absolute reduction in death attributed to tissue plasminogen activators compared with streptokinase in the GUSTO (Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries) trial (from 7.4% to 6.3%) (15). When the offsetting costs from treating later bleeding complications and recurrent deep venous thrombosis events are considered, the incremental cost per QALY gained with LMWH is less than $8000. This ratio, too, remains less than $25 000 per QALY when the authors bend over backwards to make assumptions unfavorable to LMWH. The only exception is when they assume that LMWH is less effective in preventing late complications. The cost of this therapy is also less than the $36 000 incremental cost per QALY gained from using tissue plasminogen activators instead of streptokinase in patients with acute myocardial infarction (16).

Would it have been obvious that these cost-increasing technologies—TEE and LMWH—are good value for money if these rigorous cost-effectiveness analyses had not been done? Perhaps, but the explicit and scientific nature of these studies places an appropriate burden on persons who claim that these technologies are not good value for money and should not be paid for. Open, explicit debate that incorporates evidence from objective, transparent, and well-conducted cost-effectiveness analyses will help improve the allocation of resources in health care. In this way, preventive, diagnostic, and treatment technologies can compete on a level playing field for health care dollars—which, at the turn of the millennium, are hard to come by.

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