Finding the Best Health Buys: Want to Figure Out Which Treatments Do the Most? Cost-Effectiveness Measures Show How.

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Money can't buy happiness, the old saying goes. But it can buy health—or at least it can buy the services and products that people need to be healthy. How nations spend their health dollars or lira or dinar or pesos therefore goes a long way to deciding how healthy their people are going to be.

Just how crucial are spending choices to health outcomes? Consider what a given amount of money—say, the equivalent of US$1 million--can buy. It could pay for coronary bypass operations for 40 persons whose damaged arteries put them at high risk for fatal heart attacks; or for the medicines and baby formula needed to keep hundreds of infants from catching the HIV virus that their mothers carry; or for vaccines to protect thousands of children from dying of infectious diseases. If a nation could not afford them all, the choice it made among them would determine who lives or dies.

These three interventions each effectively save lives. Each will reliably spare families the suffering and grief caused by particular deadly diseases. But each saves different lives in different numbers and at different costs. These three health interventions, in other words, have different cost-effectiveness.

When funds are inadequate to meet all possible needs—as they almost always are—knowing the effect that a particular purchase will have on health can serve as a powerful aid to decision making. This information is useful in low-income countries with very limited budgets, but the principle holds true in high-income ones as well. A Harvard University study, for example, explored the results of US$24.1 billion spent in the United States on 185 different health interventions and found that spending the same money differently and choosing the most cost-effective interventions would double the number of life years saved.

Making sound judgments on health care expenditures requires accurate information on the medical, financial, and institutional implications of interventions. To guide decision makers toward wise choices, a landmark set of three coordinated publications provides the flexible, practical and relatively simple tools that they need. *Disease Control Priorities in Developing Countries, 2nd Edition*, updates and expands the groundbreaking first edition published in 1993. *The Global Burden of Disease and Risk Factors* provides one of the largest syntheses of global information on population health and mortality. The companion volume, *Priorities in Health*, available in seven languages, presents a brief, non-technical introduction to the project's lifesaving concepts. Created by the Disease Control Priorities Project, a partnership among The Fogarty International Center of the U.S. National Institutes of Health, The World Bank, The World Health Organization, and the Population Reference Bureau, these authoritative, interrelated volumes distill the research of leading experts from countries around the world. The health interventions and recommendations that they present can save both lives and money in developing countries.

Like all comparisons, the task of calculating the level of improved health that various interventions can provide requires a standard unit of measurement—one that compares, as the saying goes, apples to apples and not to tangerines or navel oranges. One possible approach is simply counting the lives saved, as in our examples above. This method weighs all the lives equally, from the newborns who won't die of HIV to the middle-aged men and women who won't die of heart attacks. But these lives differ in various ways, such as the number years that potentially remain to them and their present and future contributions to society. Valuing all of these lives equally clearly presents analytic difficulties, but approaches that consider some of them more valuable than others or that express their value in monetary terms raise ethical issues for many people.

Nor does simply adding up deaths avoided really convey the value of health, which aims not only to avert death but foster healthy life. Surviving a disease or injury, and even living for many years, but with impairments or pain that make normal life impossible, clearly falls far short of the ideal of health. A useful and accurate unit of cost-efficiency needs to reflect that, too.

A unit that captures both of these important features—the years of life that an intervention saves and the state of health in which people live them—is called the disability-adjusted life year or DALY (pronounced "dally"). In addition to a time value, it includes a wellbeing value showing how close those who receive the intervention come to being fully healthy.

A wide range of different diseases and conditions can therefore be compared in terms of the lost DALYs they cause, both to individuals and, depending on how common they are in a given area, to the population at large. And even more usefully, treatments and interventions can be compared in terms of the lost DALYs they avert, either by preventing or by curing diseases and injuries. Dividing the amount of money that providing the treatment or intervention will cost by the number of lost DALYs it prevents gives the cost per DALY averted, which measures its cost-effectiveness.

The million dollars spent on vaccinations, therefore, can save between 50,000 and 500,000 DALYs at US$2 to US$20 each. Spent on the medications and baby formula for the infants of HIV-infected mothers in sub-Saharan Africa, the same sum will buy between 5000 and 20,000 DALYs at US$50 to US$200 each, more expensive but still an excellent buy. Spent on coronary bypass surgery, however, the money returns only about of 40 DALYs at perhaps US$25,000 each. Though an effective way of saving lives, the operation is obviously much less cost-effective than the other two treatments. The cost-effectiveness of a given intervention will vary somewhat in different countries, depending on the local price level, the number of affected persons the treatment can reach, and the local severity of the disease.

Calculating DALYs

A year lived in complete health counts as 1.0 DALY. A death, on the other hand, is worth 0.0 DALY. A year spent in less than total health counts as some portion of a DALY, the exact amount determined by the severity of the incapacity that affected individuals typically suffer, a judgment based on expert estimate. The calculation also considers the length of time the disease or condition generally lasts, ranging from a stretch of acute illness lasting only days or weeks to a lifetime of disability. To account for differences in the age when a disease, disability or death may occur, as well as for the unreliability of predicting people's future survival, years of life remaining are discounted at a rate of 3%. The DALY values for various diseases and conditions used in the DCPP come from calculations based on world-wide research results.

Cost-effectiveness thus points the way to the interventions that return the best pay-off in health. This type of analysis does not require policy makers to choose the "cheapest" interventions, but it allows them to clearly see the trade-offs of different approaches. A trio of strategies—spraying houses and providing insecticide-treated bednets in malaria-infested areas and providing intermittent preventive medicines to pregnant women—could, for example, fight the death and disability caused by malaria in sub-Saharan Africa—estimated at 35,000,000 DALYs—for between US$2 and US$24 per DALY saved. In South Asia, controlling tuberculosis could cost between US$8 and US$264 per DALY saved using methods that include childhood vaccination to prevent the disease in areas where it is endemic and the highly effective approach to treating individuals who have caught it, known as DOTS, in which a health care worker watches each time patients take their medicine. In addition to producing individual cures, this prevents the development of resistant strains.

By counting both life and health, furthermore, the DALY measure of cost-effectiveness gives ample weight to diseases that create great suffering but few deaths. No one dies of onchocerciasis, for example, but the disease's common name, river blindness, hints at the toll in disability it exacts from individuals bitten by infested black flies. The bite injects into the person's body worms that produce thousands of tiny larvae. These cause painful itching, and, over time, ugly and disfiguring lesions known as "lizard skin." But even more importantly, when they reach the eyes, they gradually cause irreversible blindness.

This damage can take decades, however, so people are generally adults—and often the breadwinners, caregivers and mainstays of their communities—by the time their sight fails. The loss of their skills, work and earnings, plus the burden of their care, devastates families. Their disability is so great that each year of river blindness is scored at a 0.6 disability weight.

Communities and national economies are devastated, too, because in the parts of sub-Saharan Africa where the infested black fly is endemic, more than one adult in three is blind and nine in ten people of all ages are infected and therefore at risk for blindness. The number of DALYs lost is immense, quite apart from the lost opportunities of young people shackled to their elders' lifelong care and the lost experience and ability in communities deprived of their vigorous adult generation. Fear of the infestation drives people from huge areas of fertile, well-watered streamside land where the black fly thrives.

Until 1974, only aerial spraying was available to kill the flies, an intervention that did nothing to heal people infested with the worms or to prevent them from reinfesting waterways. But then a new medication, ivermectin, became available and the manufacturer, Merck, agreed to provide it free wherever needed. This treatment proved highly cost-effective—US$37 per DALY averted—in part because a single pill taken once a year could kill the larvae in affected individuals. These two treatments were combined into an international effort to wipe out river blindness in 11 countries.

Challenges were considerable. To completely kill the worms and prevent re-infestation, the pills must be taken and the spraying must continue regularly for 15 to 20 years. Some localities were too inaccessible for spraying. Some countries were too poor to have public health facilities capable of distributing the medicine. In thousands of villages, however, volunteers came forward—some of them the only health-care providers in their localities—and worked to get the pills to the people who needed them. Sometimes, political instability or violence threatened to disrupt the program.

Despite these obstacles, the pill distribution and spraying continued for 3 decades, through political uprisings, conflicts and coups. Over those years, 600,000 people who would otherwise have gone blind kept right on seeing, 11 million children who would have faced the risk of blindness were born without it, and 25 million fertile hectares became homes and farms instead of wasteland. Though the campaign did not avert deaths, the lost DALYs it prevented number in many millions.

These examples only begin to suggest the power of cost-effectiveness analysis using the DALY. The three volumes of the Disease Control Priorities Project provide the means to translate the concept into countless healthy years for people everywhere.

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