COPENHAGEN CONSENSUS CENTER

Copenhagen Consensus 2008 Perspective Paper

Diseases

By

Ramanan Laxminarayan
Resources for the Future

Population health is a key determinant of economic well-being, but health interventions are not all equal in their ability to improve population health for a given level of spending. Recent efforts such as the Disease Control Priorities Project (DCPP) and WHO Choice project have attempted to identify health interventions that are highly cost-effective but not being widely used, while also pointing out health interventions that are not cost-effective but are adopted nonetheless.

In the challenge paper, Jamison, Bloom, and Jha (JBJ) draw on the accumulated knowledge of the Disease Control Priorities Project to describe the 10 health interventions with the greatest potential to improve health in low- and middle-income countries.[1] Their response focuses on the benefit-cost ratios of the health interventions that offer the highest payoff and is appropriate given the constraints of the Copenhagen process. However, the challenges are not always "what" but sometimes "how." We know that cardiovascular programs are cost-effective, yet why were cardiovascular disease control programs successful in Poland but not in Russia? Similarly, why has vaccination against polio succeeded in so many countries yet failed in major states in India?

As JBJ point out, country-level and regional efforts to increase the adoption of cost-effective interventions provide growing evidence that health can be improved substantially even in fairly poor countries with weak health systems. Yet the question of why these successes are not more broadly realized has not been satisfactorily answered, either by JBJ or by projects like DCPP. It is important that future editions of DCPP and the Copenhagen Consensus pay attention to how interventions are implemented.

[1] The author discloses that he was part of the DCPP project and lead author on Chapter 2, which synthesizes cost-effectiveness results from across the various chapters.

Benefit-Cost Estimates

The starting point of improving delivery of health is to focus on priorities, and it is difficult to take issue with the priorities recommended by JBJ. It is possible that JBJ underestimate the true cost of implementing the interventions, since no provision is made for uneven system efficiency, escalating marginal costs of implementation (because the easier-to-cover regions are already covered and existing personnel are already deployed), or marginal excess burden of tax revenues needed to pay for the interventions. However, even if one were to assume a cost that is two or three times the magnitude of what is estimated, the benefit-cost ratios indicate extraordinarily good value for money. Moreover, it is likely that benefits are also underestimated in these calculations, as discussed below.

Cost estimates

JBJ's cost estimates assume efficient health systems. Bringing health systems up to snuff is partly a matter of additional resources but may be constrained by other factors, such as insufficient regulatory capacity, that cannot be solved in the short term. And in many countries, even when health care is provided largely by the private sector, health system capacity may exist in the cities but be poor or nonexistent in rural areas. Figures 1 and 2 show percentages of primary health centers (PHCs) in India that have adequate infrastructure and staff in different states. In the poorly performing states, fewer than a third of PHCs have at least 60 percent of the basic infrastructure. A relatively higher proportion have the requisite staff, but attendance is poor. Absenteeism is an issue not just in India but also in Bangladesh, Ecuador, Indonesia, Peru, and Uganda, where recent survey data showed that 35 percent of health workers were absent (Table 1) (Chaudhury, Hammer et al. 2006). A recent study estimated the cost of improving health systems in India to be on the order of US$1 billion to $1.5 billion per year (Chow, Darley et al. 2007).

Some of the cost estimates used in the paper have been updated since DCPP. For instance, a recent study estimates that US$47 billion is required for TB control during 2006–2015 (94 percent for country-level implementation, 6 percent for international technical agencies), of which US$3 billion per year is for diagnosis and treatment for drug-susceptible TB in directly observed treatment short-course (DOTS) programs (Floyd and Pantoja 2007). The total resources required each year will be at least twice the $1.8 billion spent on TB control in 2005. The benefits of the additional $1.8 billion are estimated to exceed costs by a factor of 15, impressive yet markedly lower than what JBJ report (Laxminarayan, Klein et al. 2007).

Finally, costs may be underestimated because no provision is made for the marginal excess burden of expenditures, which must apply whether the interventions are financed by national governments or by external donors. Warlters and Auriol (2005) estimate the marginal cost of $1 of public funds to be $1.17, based on a sample of 38 African countries. A more conservative figure would be a factor of 1.3, which is commonly used in developed countries where interventions are paid for through taxes (Ballard, Shoven et al. 1985; Browning 1987).

Benefit Estimates

JBJ are likely conservative in their estimates of the economic gains from the recommended interventions. They use a figure of $1,000 per disability-adjusted life year (DALY) averted to estimate the benefits from health improvements. As they discuss, the value of a statistical life year (VLSY) offers a broader measure of the economic gain. Health improvements are unique because they extend the lifespan over which material gains from GDP growth can be enjoyed. A growing number of papers on the economic value of health improvements (Usher 1973; Nordhaus 2002; Becker, Philipson et al. 2003; Murphy and Topel 2005) impute the value of increased life expectancy on economic well-being using revealed-preference approaches to value each year of longer life. As JBJ describe, longevity gains can be quantitatively important when one is measuring welfare. Becker and colleagues find that when longevity gains are taken into consideration, average yearly "full income" grew 4.1 percent between 1960 and 2000 for the poorest 50 percent of countries, of which 1.7 percentage points were due to health (Becker, Philipson et al. 2003). The implication is that much of the welfare improvement in poorer countries over the past few decades has come in the form of improved health and that the economic contribution of these longevity increases is important.

What is the most reasonable value of a year of potential life gained? Viscusi and Aldy (2003) review more than 60 studies of mortality risk premiums from 10 countries and estimate an income elasticity of the value of a statistical life of about 0.5 to 0.6, but their elasticity estimates are influenced downward by three extreme observations for India. Dropping these observations yields an elasticity of roughly 1 (Becker and Elias 2003), and this is the value used in more recent studies (Becker, Philipson et al. 2003). Using their elasticity estimate and starting from the U.S. VSL of $4 million (associated with a U.S. per capita GDP of roughly $30,000), we can compute the VSL of India (with per capita GDP of $660) to be $61,000. This roughly translates to $1,200 to $3,000 per year of life saved, assuming a 65-year life expectancy and a 0 to 3 percent discount rate. India likely ranks on the lower side of GDP for low- and middle-income countries. For a country like China, with a GDP per capita of $1,337, one can compute a VSLY that is between $2,500 and $6,400.

It is also important to consider the positive externalities of controlling communicable diseases. The benefits of TB control, as is the case with other communicable diseases,

accrue not just to the patients but also to those around them who are at risk of infection. On average, each person with active and untreated TB will infect between 10 and 15 people every year, a few of whom will ultimately develop an active TB infection. Therefore, the benefits of TB case detection and treatment include not just the productivity gains in the treated individual, but also the averted productivity losses in individuals at risk of being infected. The chapter on TB in DCPP did use a dynamic model of infection to compute the external benefits of TB control, but this was an exception (Dye and Floyd 2006). If the benefits of control of other infectious diseases, such as malaria and vaccine-preventable diseases, include the effect of these averted losses, it is likely that the effects will be even larger than those reported in JBJ.

An important consideration in future exercises of the kind attempted here is sensitivity to underlying model parameters, both economic and epidemiological. Giving policymakers a better sense of the confidence ranges using Monte Carlo or Latin hypercube sampling methods would inspire greater assurance at the time of application. For instance, a recent study examining the benefit-cost ratios of TB interventions in the 22 high-burden endemic countries found that marginal benefits exceeded costs at baseline, but a sensitivity analysis showed that benefit-cost ratios were unambiguously greater than one in only 12 of the 22 countries (Laxminarayan, Klein et al. 2007).

Feasibility of Bringing Interventions to Scale

JBJ point to specific successes described in "Millions Saved," a product of DCPP (Levine 2004). These include interventions that also top the list in JBJ, such as tuberculosis control, HIV prevention, and tobacco control. Cost-effectiveness motivates what policymakers should focus on but does not explain why interventions succeed in some places and fail in others. One reason may be that national governments have not tried hard enough. However, this does not account for national constraints in program implementation that go beyond system capacity in the conventional sense. For instance, eliminating iodine deficiencies through salt iodization was possible in China because there were a few large manufacturers that could be easily regulated (Levine 2004). In India, such a program would be difficult to implement because of the large number of small manufacturers and the lack of regulatory capacity to ensure effective iodization among them. Another example is Chagas disease control in South America, made possible by the region's economic prosperity (Levine 2004). Although rising income does not necessarily mean that cost-effective disease interventions will be undertaken, it may ensure that interventions are more likely to succeed.

The scalability of local successes in malaria control is increasingly evident. Recent studies indicate that malaria can be rolled back across Africa using the tools that JBJ identify – insecticide-treated bednets, indoor residual spraying, and provision of effective artemisinin-based antimalarials (Bhattarai, Ali et al. 2007; Sharp, Kleinschmidt et al.

2007). The main concern continues to be the sustainability of reductions when donor attention is not replaced by national prioritization of disease control (D'Alessandro, Olaleye et al. 1995).

In the area of noncommunicable disease control, JBJ identify some clear priorities, such as increasing tobacco taxes that may not necessarily require external assistance. In fact, there are good fiscal reasons for national governments to tax tobacco and alcohol, namely to raise revenue, thereby reducing the burden on other taxes to pay for public spending (Parry, Laxminarayan et al. 2004). General equilibrium analyses from the Ramsey tax literature demonstrate that optimal commodity taxes exceed levels warranted on externality grounds for commodities that are relative leisure complements, the more so the more inelastic the own-price demand (e.g., Sandmo 1975).[2] Other priorities for controlling noncommunicable diseases include managing heart attacks with low-cost drugs and improving surgical capacity at district hospitals. These are important to focus on because donors have traditionally been reluctant to engage in these areas. Donor assistance alone may not be enough to bring these interventions to scale, but they can serve an important demonstration role that may motivate national policymakers to do more.

Innovations in Health Financing

As JBJ acknowledge, additional financial resources cannot by themselves achieve the desired health outcomes. Financial instruments used in the health sector must influence incentives for better performance, particularly within the public sector but also within the private sector where this is necessary. Financial approaches for improving public sector performance include making financial outlays conditional on performance and devolving more spending decisions to the local level. It may be worth quantifying the benefit of changes to alternative systems of financing health, since these could produce efficiency gains without necessarily requiring additional resources.

Local innovations in financing including risk pooling and community financing schemes, but the scalability of these innovations remains to proved (and they are outside the scope of the Copenhagen process). From a global perspective, remarkable returns on health investments have come in the form of new financing vehicles. Often, though not always, these have involved global financial arrangements: the same $10 billion for

[2] The result does not apply if three conditions hold simultaneously: (i) there is an optimized nonlinear income tax; (ii) leisure is weakly separable from consumption goods in utility; and (iii) preferences are identical across individuals (Atkinson and Stiglitz 1976; Saez 2002). However, all these conditions are unrealistic. For example, weak separability is rejected by empirical studies (see, e.g., Abbott and Ashenfelter 1976; Browning and Meghir 1991).

immunizations can be provided through multiple channels – UNICEF or the Global Alliance for Vaccination Initiative (GAVI), or bilateral grants or loans.[3]

GAVI has proven to be a useful way of organizing the financing of childhood immunizations, but there have been no studies to show whether this approach has been more cost-effective than the alternatives. Although GAVI might have been even more cost-effective if it had excluded the Hep B antigen (Kumar and Puliyel 2007), it has made a difference in countries with poor immunization coverage (Lu, Michaud et al. 2006). By making payments contingent on outcomes, GAVI has been able to rapidly deploy resources, despite lingering implementation and monitoring problems (Brugha, Starling et al. 2002).

A second example is the proposed Affordable Medicines Facility for Malaria (AMFm), an effort to make artemisinin-based combination therapies more affordable. The objectives of AMFm are multifaceted and include displacement of artemisinin monotherapies that may expedite parasite resistance, saving at least a small fraction of the roughly 2 million lives lost to malaria each year, ensuring a stable demand for manufacturers that enter the antimalarial market, and ensuring a drug supply that is free of expired or counterfeit medicines. But the real innovation of AMFm is that it accomplishes several of these objectives by making artemisinin drugs less expensive than other drugs. Financing mechanisms that provide grants to countries to invest in the interventions of their choice do not necessarily alter relative prices; thus, a country using funds from the Global Fund to buy antimalarials may still choose to buy cheaper, less effective drugs because it can purchase more medicine for a given budget allocation. Changing relative prices is a particularly effective mechanism for influencing intervention choices within countries while allowing for flexibility in national decisionmaking.

Closing Thoughts

The priority health interventions described in JBJ are supported by the weight of evidence compiled in the Disease Control Priority Project, a recent global priority-setting exercise. The priorities rightly emphasize the importance of expanding interventions against TB, HIV, and malaria while also engaging the growing challenge of noncommunicable diseases. Each of these priorities, whether increasing coverage of DOTS for TB prevention and control or ramping up HIV prevention programs, has been shown in specific contexts to improve health, but less is known about why these interventions take off in some places but fail in others. They represent those with the greatest ratio of benefits to costs within health and offer greater returns than others such

[3] See http://www.path.org/vaccineresources/files/gavi_briefcase_small.pdf for a full list of immunization financing options for national policymakers.

as investments in youth in selected countries (Knowles and Behrman 2003) and selected development bank-supported investments (Gaag and Tan 1998) (see Table 2).

This perspective paper has summarized a few observations about such priority-setting exercises in general and what they add in value to our ability to make better decisions on spending. In closing, I offer the following three points for the Copenhagen jury to consider:

1. There is great value in focusing on a few large interventions that have the greatest capacity to save lives and avert morbidity. Taking specific steps to generate and use clinical best practices, training service providers to do a few things frequently and well rather than many things poorly, and improving provider incentives by creating a legal and ethical environment where care providers do not profit personally from the sale of drugs, diagnostic procedures, or provision or referral of care: all these approaches have merit and are described elsewhere (Peabody, Taguiwalo et al. 2006).
2. The issue of how the world should spend its money is important but relevant only if the proper financing and delivery mechanisms exist. Such mechanisms must not crowd out national health expenditures, excessively distort wages and resource allocations in the health sector, or inefficiently focus on some diseases to the exclusion of others (Halperin 2008). Therefore, whatever priorities are chosen, policymakers should recognize that the additional focus on certain interventions implies doing less well on other diseases and interventions.
3. To this end, the innovations needed are not just in technology but also in delivery systems. For instance, financing the global subsidy for artemisinin-based combination therapies (ACTs), discussed by JBJ, represents a novel approach to paying for a global public good, “antimalarial effectiveness,” while also saving the lives of malaria-afflicted children.

References

Abbott, M. and O. Ashenfelter (1976). "Labour Supply, Commodity Demand and the Allocation of Time." Review of Economic Studies **43**: 389-411.

Atkinson, A. B. and J. E. Stiglitz (1976). "The Design of Tax Structure: Direct Versus Indirect Taxation." Journal of Public Economics **6**: 55-75.

Ballard, C. L., J. B. Shoven, et al. (1985). "General Equilibrium Computations of the Marginal Welfare Costs of Taxes in the United States." American Economic Review **75**: 128-38.

Becker, G., T. Philipson, et al. (2003). "The Quantity and Quality of Life and the Evolution of World Inequality." American Economic Review **95**(1): 277-91.

Bhattarai, A., A. S. Ali, et al. (2007). "Impact of Artemisinin-Based Combination Therapy and Insecticide-Treated Nets on Malaria Burden in Zanzibar." PLoS Med **4**(11): e309.

Browning, E., K. (1987). "On the Marginal Welfare Cost of Taxation." American Economic Review **77**: 11-23.

Browning, M. and C. Meghir (1991). "The Effects of Male and Female Labor Supply on Commodity Demands." Econometrica **59**: 925-951.

Brugha, R., M. Starling, et al. (2002). "GAVI, the First Steps: Lessons for the Global Fund." Lancet **359**(9304): 435-8.

Chaudhury, N., J. Hammer, et al. (2006). "Missing in Action: Teacher and Health Worker Absence in Developing Countries." Journal of Economic Perspectives **20**(1): 91-116.

Chow, J., S. Darley, et al. (2007). Cost-Effectiveness of Disease Interventions in India. Washington DC, Resources for the Future Discussion Paper 07-53.

D'Alessandro, U., B. O. Olaleye, et al. (1995). "Mortality and Morbidity from Malaria in Gambian Children after Introduction of an Impregnated Bednet Programme." Lancet **345**(8948): 479-83.

Dye, C. and K. Floyd (2006). Tuberculosis. Disease Control Priorities in Developing Countries (2nd Edition). D. T. Jamison. New York, Oxford University Press. **:** 289-312.

Floyd, K. and A. Pantoja (2007). Financial Resources Required for TB Control to Achieve Global Targets Set for 2015. Stop TB Department Report. Geneva, World Health Organization.

Gaag, J. v. d. and J.-P. Tan (1998). The Benefits of Early Child Development Programs: An Economic Analysis. Washington DC, World Bank.

Halperin, D. (2008). Putting a Plague in Perspective New York Times. **Oped**.

Knowles, J. C., and J. R. Behrman (2003). Assessing the Economic Benefits of Investing in Youth in Developing Countries. Washington DC, World Bank.

Kumar, A. and J. Puliyel (2007). "GAVI Funding and Assessment of Vaccine Cost-Effectiveness." Lancet **369**(9557): 189; author reply 189.

Laxminarayan, R., E. Klein, et al. (2007). Economic Benefit of Tuberculosis Control. Washington DC, Policy Research Working Paper No. 4295

Levine, R. a. t. W. W. W. G. (2004). Millions Saved: Proven Successes in Global Health. Washington, DC, Center for Global Development.

Lu, C., C. M. Michaud, et al. (2006). "Effect of the Global Alliance for Vaccines and Immunisation on Diphtheria, Tetanus, and Pertussis Vaccine Coverage: An Independent Assessment." Lancet **368**(9541): 1088-95.

Murphy, K. M. and R. H. Topel (2005). The Value of Health and Longevity. Cambridge, MA, NBER Working Paper 11045.

Nordhaus, W. (2002). The Health of Nations: The Contribution of Improved Health to Living Standards. The Economic Value of Medical Research. K. Murphy and R. Topel. Chicago, University of Chicago Press.

Parry, I. W., R. Laxminarayan, et al. (2004). The Critical Importance of Fiscal Considerations in Evaluating Alcohol Policies. Washington DC, Resources for the Future.

Peabody, J. W., M. M. Taguiwalo, et al. (2006). Improving the Quality of Care in Developing Countries. Disease Control Priorities in Developing Countries (2nd Edition). D. T. Jamison. New York, Oxford University Press. **:** 1293-1308.

Saez, E. (2002). "The Desirability of Commodity Taxation under Non-Linear Income Taxation and Heterogeneous Tastes." Journal of Public Economics **83**: 217-230.

Sharp, B. L., I. Kleinschmidt, et al. (2007). "Seven Years of Regional Malaria Control Collaboration--Mozambique, South Africa, and Swaziland." Am J Trop Med Hyg **76**(1): 42-7.

Usher, D. (1973). An Imputation to the Measure of Economic Growth for Changes in Life Expectancy. The measurement of economic and social performance, Studies in Income and Wealth: NBER Conference of Research in Income and Wealth. M. Moss. New York, Columbia University Press**:** 193–225.

Viscusi, W. K. and J. Aldy (2003). "The Value of a Statistical Life: A Critical Review of Market Estimates throughout the World." Journal of Risk and Uncertainty **27**(1): 5-76.

Warlters, M. and E. Auriol (2005). The Marginal Cost of Public Funds in Developing Countries: An Application to 38 African Countries. Washington DC, World Bank Policy Research Working Paper No. 3679.

Figure 1

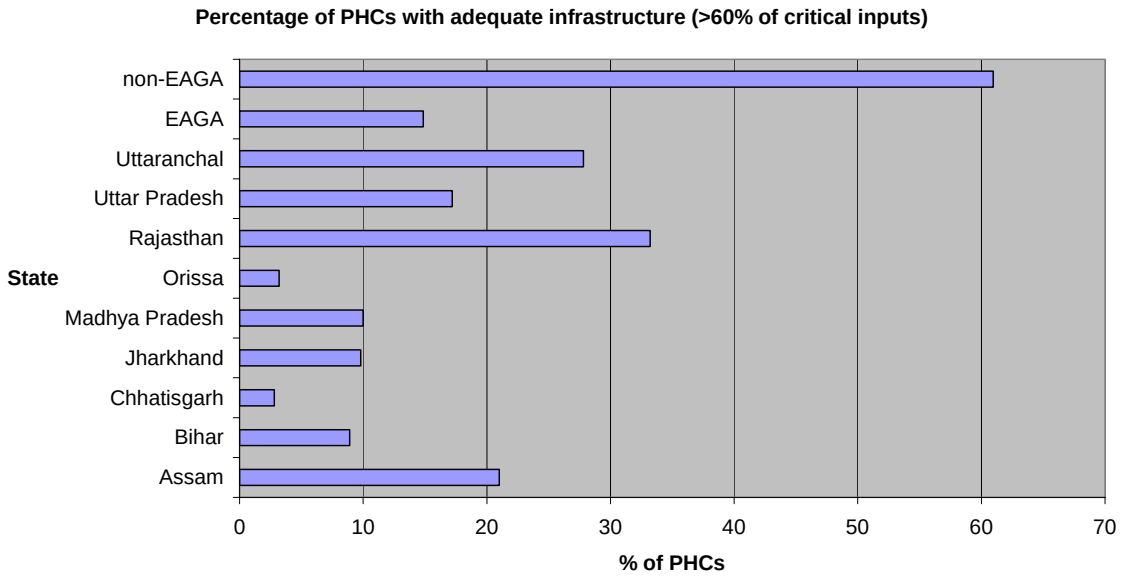

Figure 2

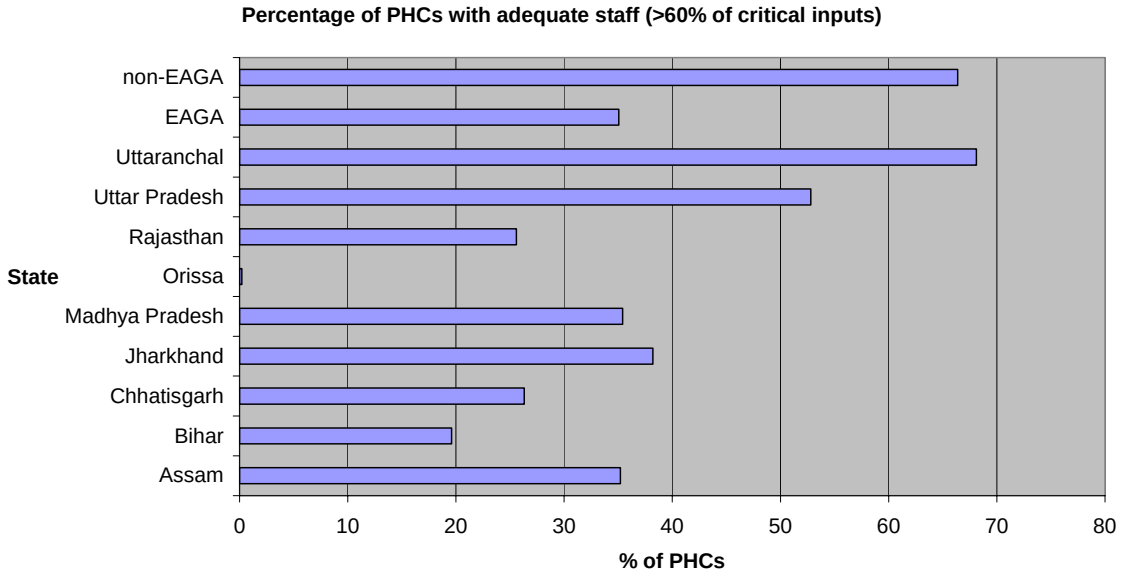

Table 1

Table 1
Provider Absence Rates by Country and Sector

	Absence rates (%) in:	
	Primary schools	Primary health centers
From this project:		
Bangladesh	16	35
Ecuador	14	--
India	25	40
Indonesia	19	40
Peru	11	25
Uganda	27	37
Unweighted average	**19**	**35**

Notes: (1) Providers were counted as absent if they could not be found in the facility for any reason at the time of a random unannounced spot check (see text for further detail).
(2) In Uganda, the sampled districts were divided into sub-counties, and schools in sub-counties with level III health centers comprise the school sampling frame. This sampling strategy may have had the effect of understating slightly the national absence rate there, given that schools in more rural areas appear to have higher absence rates.

Table 2. Estimated benefit-cost ratios of some other programs evaluated by the World Bank

Estimated benefit-cost ratios of some investments in youth in selected countries		
Investment	*Estimated benefit-cost ratio (assuming 5% annual discount rate)*	*Plausible ranges in estimated benefit-cost ratio*
Scholarship program (Colombia)	3.31	2.77 to 25.63
Adult basic education and literacy program (Colombia)	19.9	8.14 to 1,764
School-based reproductive health program to prevent HIV/AIDS (Honduras)	0.493	0.102 to 4.59
Iron supplementation administered to secondary school children (low-income country)	32.1	25.8 to 45.2
Tobacco tax (middle-income country)	11.34	6.96 to 38.56
Source: Knowles and Behrman (2003)		
Benefit-cost ratios for selected development bank-supported investments		
Project (year)		*Benefit-cost ratio*
Hill Forest Development Project, Nepal (1983)		1.18
Irrigation Systems Improvement Project, Philippines (1977)		1.48
Livestock Development Project, Uruguay (1970)		1.59
Livestock and Agricultural Development Project, Paraguay (1979)		1.62
Cotton Processing and Marketing Project, Kenya (1979)		1.80
Source: Gaag and Tan (1998)		