THE VALUE OF VACCINATION

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October 24, 2014
Vaccination then and now

Edward Jenner
(1749-1823)
What we will cover today…

1) Review new ideas on key links between health and wealth

2) Discuss the role of vaccination as a driver of both health and wealth

3) Share insights from studies that operationalize the conceptual value of vaccination framework

4) Review the New Zealand context
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Life expectancy and income

Life expectancy (years)

GDP per capita (current US$)

The value of vaccination
October 24, 2014
From income to health…

- Nutrition
- Safe water
- Sanitation
- Health care
- Psycho-social resources
… and from health to income
... and from health to income

- Productivity
- Education
- Investment
- Demographic dividend

Sources: Bloom DE & Fink G. (2013). “The Economic Case for Devoting Public Resources to Health” in Jeremy Farrar, Nicholas White, David Lalloo, Peter Hotez, Thomas Junghanss and Gagandeep Kang, eds., Manson’s Tropical Diseases 23rd Edition, Elsevier.
Bärnighausen T, Bloom DE, Cafiero ET, O’Brien JC. (2012). Economic evaluation of vaccination: capturing the full benefits, with an application to human papillomavirus. Clinical Microbiology and Infection 18 (Suppl. 5): 1–7
Stage decorations of the public health lecture. Source: Bu (2009) from Strother F. (1918) 'An American Physician-Diplomat in China', *The World's Work*, New York: Doubleday, page and Co., p. 546.
A 10 year gain in life expectancy translates into up to 1 additional percentage point of annual growth of income per capita.
Investing in health

Global health 2035: a world converging within a generation

The Lancet Commission on Investing in Health

“Our report points to the possibility of achieving dramatic gains in global health by 2035 through a grand convergence around infectious, child, and maternal mortality; major reductions in the incidence and consequences of non-communicable diseases and injuries; and the promise of universal health coverage.”
A healthy population is a prerequisite for growth as much as a result of it.

Dr. Gro Harlem Brundtland
Director-General, WHO 1998-2003
On the occasion of the launch of the Report of the WHO Commission on Macroeconomics and Health
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Health and income: application to vaccination
Inattention to the full economic benefits...
Valuing vaccinations: the traditional perspective

| Perspective  | Benefit categories                      |
|--------------|-----------------------------------------|
| Narrow       | Health care cost savings                |
|              | Care-related productivity gains          |
Valuing vaccinations: a broader perspective

| Perspective | Benefit categories                  |
|-------------|-------------------------------------|
| Broad       | Health care cost savings            |
|             | Care-related productivity gains      |
| Narrow      | Outcome-related productivity gains   |
|             | Behavior-related productivity gains  |
|             | Community health externalities       |
|             | Community economic externalities     |
|             | Risk reduction gains                 |
|             | Health gains                         |
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Valuing vaccinations: selecting the right tool

Cost-effectiveness analysis

- Compares 2 or more health interventions with a common health outcome
- Outcomes expressed in terms of DALYs or gain in life years

Benefit-cost analysis

- Looks at a range of health and non-health outcomes
- Outcomes expressed in terms of a dollar value
Evolving evidence base

- ‘The value of vaccination’, *World Economics*, 2005.
- ‘Do we fully understand the economic value of vaccines?’, *Vaccine*, 2007.
- ‘Accounting for the full benefits of childhood vaccination in South Africa’, *South African Medical Journal*, 2008.
- ‘The effect of maternal tetanus immunization on children’s schooling attainment in Matlab, Bangladesh: follow-up of a randomized trial.’ *Social Science & Medicine*, 2011.
- ‘Rethinking the benefits and costs of childhood vaccination: the example of the *Haemophilus influenza* type b vaccine’, *Vaccine*, 2011.
- ‘Estimated economic benefits during the 'Decade Of Vaccines' include treatment savings, gains in labour productivity.’ *Health Affairs* 2011.
- The effect of vaccination on children’s physical and cognitive development in the Philippines’, *Applied Economics*, 2012.
- ‘Economic evaluation of vaccination: Capturing the full benefits, with application to HPV’, *CMI*, 2012.
- ‘Systematic review of studies evaluating the broader economic impact of vaccination in low and middle income countries’, *BMJ Public Health*, 2012.
- ‘Valuing the broader benefits of dengue vaccination, with a preliminary application to Brazil’, *Seminars in Immunology*, 2013.
Valuing vaccination, 2014

Till Bärnighausen, David E. Bloom, Elizabeth T. Cafiero-Fonseca, and Jennifer C. O’Brien

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Edited by Antionio L. Gatti, Friuli Venezia Giulia, Italy, and approved July 14, 2014; revised November 25, 2014

Vaccination has led to remarkable health gains over the last century. However, large coverage gaps remain, which will require significant financial resources and political will to address. In recent years, a compelling line of inquiry has established the economic benefits of health care at both the individual and aggregate levels. Most existing economic evaluations of particular health interventions fail to account for this new research. Leading to more precise and personalized selection of these interventions. Hence, this new research is not just a finance but also a strategy for characterizing the full benefits of vaccination to minimize avoidable medical care costs, help estimate production gains, community health expenditures, community economic externalities, and the value of risk reductions and ease health care. This also means it highlights the importance of these sources of benefit for different vaccinations. Finally, we outline the steps that need to be taken to implement a broad-based approach to economic evaluation and discuss the implications of this work for research, policy, and resource allocation for vaccine development and delivery.

benefit cost analysis | vaccines

The prevention of illness and death through vaccination is commonly regarded as one of the greatest public health achievements of the 20th century [1, 2]. Globally, coverage with all major vaccinations has doubled since 2000 [7, 11] (5). Today, more than 100 million children are vaccinated annually against diseases such as diphtheria, tetanus, pertussis, polio, measles, and hepatitis B. These and other vaccines prevent an estimated 2.5 million deaths each year (6). Vaccination programs have also led to the eradication of smallpox, the near eradication of polio, and an estimated 70% reduction in measles deaths over the last 10 years (6, 7).

Economic benefits, an estimated 15 million infant health results in a cost-effective return of $3 for every $1 invested in vaccines. In low-income countries from 2011 to 2020 (9). By comparison, the current biennial budget of the World Health Organization is only $4 billion (13). Major financial commitments are required from governments and other stakeholders to fully scale up vaccinations. Such commitments can be justified on many grounds, including the fact that vaccination safeguards health, which is a fundamental human right and intrinsically valuable. However, when governments are faced with difficult decisions about how to allocate scarce resources, systematic comparisons of the benefits and costs of each option can be quite important.

In recent years, the instrumental value of health for economic development has been well researched and documented (11). It has been shown that the population health can operate through multiple channels to provide a significant boost to economic growth, which can in turn generate additional resources to invest in health. Healthy adults tend to work longer and harder, healthy children tend to have better records of school attendance and educational attainment and better cognitive function (11, 12), and healthy population health in turn yields an approach to robust and powerful drivers of economic wellbeing. We discuss a theoretical framework that highlights the full economic benefits of vaccination, which extend well beyond the benefits traditionally captured by economists in economic evaluations of vaccinations. We also review evidence on the magnitude of these benefits and outline an approach to the economic evaluation of vaccination that identifies and takes account of these benefits. We conclude with a critical discussion of the implications of this work for research, policy, and resource allocation.

Broader Perspective on the Value of Vaccination

Many health interventions, including vaccinations, have been subjected to economic evaluation. Historically, economists have taken a narrow approach to valuing vaccination benefits by focusing strictly on a subset of the potential health benefits from reduced health care spending. Some existing studies also capture productivity gains but do so because vaccination causes people from living productive time and pay for their own health care services or the need to provide care for their children or...
GAVI: The power of productivity …

A drop of pure gold

“A group of researchers attempts to estimate the economic benefits of vaccination.”

Source: Bloom DE, Canning D, and Weston M. “The Value of Vaccination”. World Economics 8:15-39, July-September 2005
Philippines: cognitive development

Cognitive development improvements generate an estimated rate of return to investment in a basic immunization program of 21%

Source: Bloom DE, Canning D, and Seiguer E. “Childhood Immunization as Human Capital”, (working manuscript)
‘Rethinking the benefits and costs of childhood vaccination: the example of the Hib vaccine’
Valuing the broader benefits of dengue vaccination, with a preliminary application to Brazil

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**ABSTRACT**

The incidence of dengue has been on the rise since at least the 1960s, bringing greater urgency to the need for a vaccine to prevent the disease. Recent advances suggest that the scientific world is moving closer to an effective dengue vaccine. However, there are concerns that the price of a future vaccine could limit its uptake. High prices, in addition to other challenges, have already weighed negatively in government decisions to include other new vaccines in national immunization programs, e.g., the pneumococcal, rotavirus, and human papillomavirus vaccines. Recent research on the value of vaccination, however, suggests that vaccination confers benefits that are often neglected by traditional economic evaluations. In the case of dengue, commonly overlooked benefits are likely to include reduced spending on outbreak control, averted losses in tourism flows, and avoided productivity losses due to long-term dengue sequelae. Accounting for these and other broader benefits of dengue vaccination could reveal significantly greater economic value and strengthen the case for inclusion of dengue vaccination in national immunization programs. In this article we discuss a framework for the broader value of vaccination and review its application in the context of dengue vaccination for Brazil.
Dengue in Brazil

Sao Paulo Dengue Fever Outbreak Concerns World Cup Visitors, Officials

By Connor Adams Sheets  @ConnorASheets
on June 20 2014 6:38 PM

Dengue Fever Cases Triple in Brazil: Daily

By Leo Byrne, Contributing Reporter

RIO DE JANEIRO, BRAZIL – The ministry of health reported today that the number of dengue fever cases in the country was three times higher than during the same period last year. Although the number of serious cases and deaths decreased by 44 and 20 percent respectively, the total number of cases rose to 290,653 in the first seven weeks of the year.

The Secretary of Health Observation, Jonas Barbosa attributed the increase to a different strain of the disease, known as DEN-4 which has been circulating Brazil since 2011. A higher than usual incidence of mosquitoes was also to blame.

“Every time we have a new strain in a place where it has never previously circulated, more people are susceptible. In 2013 [DEN-4] hit big cities and this greatly increased the number of cases,”
Economic evaluation of vaccination: capturing the full benefits, with an application to human papillomavirus

Abstract

Vaccination has been among the greatest contributors to the past century’s dramatic improvements in health and life expectancy. Recent advances in vaccinology have resulted in new vaccines that will likely lead to substantial future health gains. However, the high cost of these new vaccines, such as the human papillomavirus (HPV) vaccine, poses an obstacle to their widespread adoption in many countries. Economic evaluation can help to determine if investment in vaccine introduction is worthwhile. However, existing economic evaluations usually focus on a narrow set of vaccination-mediated benefits—most notably avoided medical-care costs—and fail to account for several categories of potentially important gains. We consider three sources of such benefit and discuss them with respect to HPV vaccination: (i) outcome-related productivity gains, (ii) behaviour-related productivity gains, and (iii) externals. We also highlight that HPV vaccination protects against more than just cervical cancer and that these other health gains should be taken into account. Failing to account for these broader benefits of HPV vaccination could result in substantial underestimation of the value of HPV vaccination, thereby leading to ill-founded decisions regarding its introduction into national immunization programmes.

Keywords: Benefit-cost analysis, economic evaluation, economics, externals, human papillomavirus vaccine, vaccination

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Notified cases of meningococcal disease, NZ 1975-2013

Lopez, I. and Sherwood, J. The Epidemiology of Meningococcal Disease in New Zealand in 2013-2014, Institute of Environmental Science and Research Ltd. (ESR) Wellington, New Zealand.

MeNZB implemented in routine childhood vaccination schedule
Disparities in coverage rates persist: NZ eight-month-olds

Ministry of Health, National Immunization Register 2014
Final remarks

- Don’t focus on costs in isolation
- Need better data and more evidence
- Trust the facts