GLOBAL PUBLIC GOODS AND GLOBAL HEALTH

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INTRODUCTION

Many of today's biggest global challenges reflect failures of collective action in providing global public goods. When it comes to preventing pandemic disease, climate change, or weapons proliferation, there are strong incentives for national governments not to cooperate to provide optimal levels of global public goods. In order to better understand those incentives in the context of global health challenges, leading categories for distinguishing different types of global public goods ought to be re-conceptualized as highlighting different stages of production of global public goods. While the conventional wisdom remains that wider participation is essentially an obstacle to effective collective action, leveraging the contributions of diverse actors can contribute to catalyzing the effective provision of global public goods.

This article advances a new analytical approach to the challenge of providing global public goods that highlights the distinct problems of innovation, financing, and compliance. Part I analyzes the major obstacles to providing global public goods and the existing frameworks for conceptualizing these obstacles. Part II uses existing frameworks to analyze several specific global health challenges in order to gain insight into the different dimensions of global public goods production and the growing role of non-state actors in providing global public goods. Part III introduces an alternative approach to conceptualizing global public goods and highlights its implications for governance and global public goods.

I. CATEGORIZING GLOBAL PUBLIC GOODS

Recent scholarship has highlighted the significant institutional and legal obstacles involved in the provision of global public goods, but such

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problems have been recognized for many years.[1] The concept of public goods was first highlighted three centuries ago by David Hume.[2] He identified what has come to be known as the "free rider" problem: the incentive for an individual to "free himself of the trouble and expense, and . . . lay the whole burden on others."[3] Since that time, the concept of public goods has been elaborated upon by many leading economic thinkers. Adam Smith recognized the existence of certain goods

> which though they may be in the highest degree advantageous to a great society are, however, of such a nature that the profits could never repay the expense to any individual or small number of individuals, and which it therefore cannot be expected that any individual or small number of individuals should erect.[4]

The challenge with such public goods is that there are weaker incentives for private provision because their benefits generally cannot be made excludable and their consumption generally cannot be made exclusive.

The challenge of providing public goods is commonly viewed as becoming increasingly difficult as the number of participants involved expands. This view reflects Mancur Olson's work on collective action problems and his conclusion that the obstacles to cooperation increase along with the number of participants whose cooperation is required.[5] Olson found that only small groups, or those groups with selective incentives, will collectively organize. The larger the group, Olson argued, the "farther it will fall short in providing the optimal amount of a collective good."[6] Even today, the conventional wisdom reflects his view that wider participation generally makes the provision of public goods less likely.

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1. *See* Daniel Bodansky, *What's in a Concept? Global Public Goods, International Law, and Legitimacy*, 23 EUR. J. INT'L L (forthcoming 2012); William D. Nordhaus, Some Foundational and Transformative Grand Challenges for the Social and Behavioral Sciences: The Problem of Global Public Goods (unpublished manuscript) (2010), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1889357; Ernst-Ulrich Petersmann, *International Economic Law, "Public Reason", and Multilevel Governance of Interdependent Public Goods*, 14 J. INT'L ECON. L. 23 (2011); Gregory Shaffer, *International Law and Global Public Goods in a Legal Pluralist World*, EUR. J. INT'L L. (forthcoming 2012).

2. DAVID HUME, A TREATISE OF HUMAN NATURE 538 (1739).

3. *Id.*

4. ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 210-11 (1802).

5. MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS 53 (1994).

6. *Id.* at 35 (emphasis omitted).

National governments often overcome these challenges by stepping in and providing many important public goods at the national level, but at the global level, the lack of effective governance multiplies the challenge of collective action. Twenty-five years ago, Charles Kindelberger highlighted the fact that in a world without effective governance, it was unclear who would ensure the provision of global public goods.[7] Contemporary economists continue to identify the lack of any "governmental mechanisms" for the provision of global public goods as the key obstacle to overcoming this market failure.[8] The limited capacity of existing international institutions allows many national governments to free-ride rather than contribute and constrains progress on many key global public goods challenges.

In response to these challenges, scholars have sought to categorize different types of global public goods in order to better understand the major obstacles to their provision. One of the most ambitious attempts to categorize global public goods was outlined by Scott Barrett in his book *Why Cooperate?: The Incentive to Supply Global Public Goods*. Barrett points out that some global public goods can be supplied only if every country cooperates, some global public goods demand the cooperation only of certain countries, and some require only the best effort of a single country.[9] For "weakest-link" global public goods, which require the participation of every country for success, Barrett offers the example of smallpox elimination.[10] In the case of smallpox, unless the population of every single country was successfully vaccinated, no country would benefit from the elimination of the threat posed by the disease. For "aggregate effort" global public goods, which require cooperation by some but not all countries, he offers the example of climate change mitigation.[11] Without the major emitters reducing their emissions, reducing greenhouse gas production is unlikely to succeed, but it does not necessarily require all countries to participate in order to do so. For "single best-effort" global public goods, which may require action only by a single country, Barrett offers the example of deflecting an asteroid to prevent a collision with the

7. *See* Charles Kindelberger, *International Public Goods Without Government*, 76 AM. ECON. REV. 1, 8 (1986).

8. *See* William Nordhaus, Some Foundational and Transformative Grand Challenges for Social and Behavioral Sciences: the Problem of Global Public Goods 2 (Oct. 3, 2010) (unpublished manuscript), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1889357.

9. *See* SCOTT BARRETT, WHY COOPERATE?: THE INCENTIVE TO SUPPLY GLOBAL PUBLIC GOODS 2 (2007). Barrett's work builds on the insights of Jack Hirsleifer, *From Weakest Link to Best Shot: The Voluntary Provision of Public Goods*, 41 PUB. CHOICE 371 (1983).

10. *Id.* at 47-48.

11. *Id.* at 74-102.

Earth.[12] One country could develop the technology needed to protect against the planetary threat of an asteroid and provide a global public good that might protect all of humanity.

Barrett's typology is an extremely valuable contribution to analyzing how different kinds of global public goods might require different types of institutional responses to ensure adequate provision. Yet it suffers from two important weaknesses that can undercut its capacity to be translated into effective institutional design. First, many global public goods do not fit into only one of the categories which Barrett outlines. Indeed, in different parts of his book, vaccines emerge as a weakest-link public good, in terms of the difficulty of eliminating diseases in failing states;[13] a single best-effort public good, in terms of the discovery of vaccines;[14] and as an aggregate effort public good, in terms of financing mass vaccination campaigns.[15] Second, Barrett's account focuses almost exclusively on the role of states but in the twenty-first century it is non-state actors who are increasingly central to ensuring the provision of global public goods.

Looking at specific global health challenges, the difficulty in fitting different global public goods into neat categories becomes even clearer. In fact, many important global health challenges have the qualities of weakest-link, aggregate effort, and single best-effort public goods all at the same time. Instead of viewing these categories as referring only to different types of global public goods, it is more helpful to view them as highlighting different stages of the production of global public goods. In the context of global health, innovation often requires only a single best-effort, while the financing of global public goods generally requires an aggregate effort, and compliance depends upon overcoming the challenge of the weakest-link. Understood in this way, these categories can be even more valuable in thinking about the type of governance structures which are required to ensure the provision of global public goods. At the same time, a clearer focus on these distinct production stages of global public goods reveals the limits of state-centric approaches and highlights the need to better incorporate the role of non-state actors into an analysis of global public goods.

12. *Id.* at 22-37.
13. *Id.* at 22-23.
14. *Id.* at 54-57.
15. *Id.* at 123-32.

II. GLOBAL HEALTH AND GLOBAL PUBLIC GOODS

Over the last decade, the framework of global public goods has increasingly been applied to analyze global health challenges.[16] While many important global health issues cannot easily be categorized as global public goods challenges, controlling emerging infectious diseases and entirely eradicating diseases both lend themselves to such an analysis.[17] The prevention and containment of infectious or communicable diseases is a classic case of a global public good. A new strain of influenza, for example, could cause tremendous loss of life in all countries around the world. Eradicating a communicable disease, such as polio, is a special case which holds enormous potential global benefits. Eradicating polio and combating pandemic flu reveal the difficulty in categorizing specific global health challenges as different types of global public goods and highlight the increasingly important role of non-state actors in the provision of global public goods.

A. Polio

Polio eradication is at once a single best-effort, an aggregate effort, and a weakest-link global public good. Successful vaccination campaigns in Latin America catalyzed the launch of a Global Polio Eradication Initiative in 1988, which sought to build on the successful model of smallpox eradication.[18] Tremendous progress since that time has been based on the discovery of a vaccine many decades earlier, the financial contributions of diverse donors, and the incorporation of decentralized approaches to ensuring compliance. Despite significant gains in recent years, complete polio eradication is not yet a reality.[19]

The current polio vaccine was invented by a single scientist, funded by a single nation, and reflects the characteristics of a "single best-effort" global public good. President Franklin D. Roosevelt, who himself suffered from the disease, helped to establish the United States National Foundation

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16. *See, e.g.*, David P. Fidler, *Germs, Governance, and Global Public Health in the Wake of SARS*, 113 CLINICAL INVESTIGATION 799 (2004).

17. *See* Richard Feachem & Jeffrey Sachs, GLOBAL PUBLIC GOODS FOR HEALTH: THE REPORT OF WORKING GROUP TWO OF THE COMMISSION FOR MACROECONOMICS AND HEALTH 4-5 (2002).

18. R.W. Sutter & C. Maher, *Mass Vaccination Campaigns for Polio Eradication: An Essential Strategy for Success*, 304 CURRENT TOPICS IN MICROBIOLOGY & IMMUNOLOGY 195, 203-05 (2006).

19. In the last decade of the twentieth century, polio cases declined by ninety nine percent from an estimated 350,000 to fewer than 500 cases by 2001. UNICEF, POLIO ERADICATION (2001), *available at* http://www.unicef.org/specialsession/about/sgreport-pdf/20_PolioEradication_D7341Insert _English .pdf; Earth Policy Institute, Two Stories of Disease: Smallpox and Polio (Sept. 15, 2011), http://www.earth-policy.org/data_highlights/2011/highlights19.

for Infantile Paralysis in 1938.[20] The National Foundation lavishly financed a number of top scientists, including Dr. Jonas Salk who invented a vaccine after nearly a decade of focused research on polio.[21] The National Foundation also conducted the Salk Vaccine Field Trials, involving nearly two million children in the United States, to test the efficacy of the vaccine.[22] Without unprecedented investment by a single institutional actor in a single country, the polio vaccine, which is now so central to global eradication efforts, might not exist and certainly would have taken much longer to be developed.

In terms of financing the eradication of polio, the ongoing challenge reflects the characteristics of an aggregate effort public good. Given the extremely high ratio of global benefit to the cost of disease eradication, one might expect that it would be among the easiest global public goods for which to secure financing. Yet even smallpox took nearly two centuries to eradicate. The international community struggled to raise the financing needed to complete the campaign to eliminate smallpox because the World Health Organization (WHO) lacked the authority to compel contributions from member states.[23] Similarly with polio, the WHO found that the lack of adequate finance poses "the single greatest threat to realizing the historic eradication goal."[24] The polio eradication campaign was ultimately able to fund a comprehensive global response only because of significant contributions by non-state actors.[25] The Rotary Club became one of the most important donors to the initiative, contributing approximately $1 billion to the effort.[26] In more recent years, the Bill and Melinda Gates Foundation has stepped into a key financing role and catalyzed renewed interest among many other donors.[27]

Although the polio eradication campaign made enormous progress in its early years, efforts to secure the level of compliance necessary to eliminate the disease display weakest-link characteristics. Eliminating the last one percent of cases has proven enormously difficult and a resurgence

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20. DAVID OSHINSKY, POLIO: AN AMERICAN STORY-THE CRUSADE THAT MOBILIZED THE NATION AGAINST THE 20TH CENTURY'S MOST FEARED DISEASE 53 (2005).

21. *Id.* at 5.

22. *See id.* at 6.

23. Scott Barrett, *The Smallpox Eradication Game*, 130 PUBLIC CHOICE 179, 180 (2007).

24. *Id.* at 182.

25. R. Bruce Aylward et al., *Polio Eradication*, *in* GLOBAL PUBLIC GOODS FOR HEALTH 40 (Richard Smith et al. eds., 2003).

26. *Id*. at 41.

27. *UK and Gates Foundation Commit to Polio Eradication*, U.K. DEP'T FOR INT'L DEV (Jan. 28, 2011), http://www.dfid.gov.uk/news/latest-news/2011/polio-eradication-with-gates-foundation/.

of polio quadrupled the number of cases between 2001 and 2005.[28] An important contributor to this reversal was the decision by several states in northern Nigeria to suspend their vaccination campaigns after some religious leaders endorsed rumors that the polio vaccine caused infertility.[29] In the wake of this reversal of progress, community ownership of immunization programs became a major priority in many areas of high non-compliance. After an outbreak in India, the Global Polio Eradication Initiative began successfully working with informal social networks and training community members as local champions.[30] In India, religious leaders endorsed the vaccination campaign and thousands of women were recruited to spread the message door-to-door as part of an overall effort by 2.3 million vaccinators to successfully vaccinate 900 million children in 2011. As of the beginning of 2012, India was removed from the list of endemic countries but polio remains a serious challenge in countries such as Nigeria, Pakistan, and Afghanistan.[31]

The example of polio highlights how a single global health challenge can at once reflect the characteristics of single best-effort, aggregate effort, and weakest-link public goods. Viewing these categories as reflecting the different stages of global public goods production offers greater understanding of the unique challenges involved in each stage of production. The challenge of polio eradication reveals the growing importance of non-state actors at each stage: from the discovery of the polio vaccine, to the resource mobilization for polio eradication, to successful vaccination campaigns in hard to reach communities.

B. Pandemic Flu

Among global health challenges, an emerging flu virus is one of the deadliest potential threats for which global collective action is required. In the United States alone, the Spanish influenza virus in the early twentieth century infected more than a quarter of the population and killed two and a half percent of all those infected.[32] Although the most recent new flu strain proved less deadly than feared, it could well be a precursor to future mutations that pose a much greater threat. Without significantly improved

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28. Heidi Larson & Isaac Ghinai, *Lessons from Polio Eradication*, 473 NATURE 446, 447 (2011).

29. Barrett, *supra* note 9, at 55. During the same period local families in northern Nigeria were suing a leading drug manufacturer for allegedly performing unethical clinical trials in the region. Larson & Ghinai, *supra* note 28, at 446.

30. Larson & Ghinai, *supra* note 28, at 447.

31. Simon Denyer, *For India, a Milestone in the Fight Against Polio*, WASH. POST, Jan. 12, 2012, at A10.

32. Jeffrey K. Taubenberger, *The Origins and Virulence of the 1918 'Spanish Influenza Virus'*, 150 PROC. AM. PHIL. SOC'Y 86, 90 (2006).

disease surveillance and tailored treatments, it will be extremely difficult to respond to an emerging flu virus. The different challenges involved in combating pandemic flu reflect the characteristics of single best-effort, aggregate effort, and weakest-link global public goods.

Global surveillance of new strains of the flu virus highlights the weakest-link characteristics of pandemic flu. In 2003, the SARS crisis demonstrated the inadequacy of the existing legal framework for responding to emerging global health challenges. Article 21(a) of the Constitution of the WHO authorizes the adoption of regulations regarding "sanitary and quarantine requirements and other procedures designed to prevent the international spread of disease."[33] At the time, the WHO was only allowed to rely on national governments for confirmation of an outbreak within a given country. Amidst growing evidence of cases originating within China, the Chinese government refused to reveal that it had any cases of SARS.[34] China did not even have a clear legal obligation to report these cases because the existing regulations did not adequately encompass new and emerging diseases. Under that system, the WHO was entirely dependent on voluntary compliance by states in reporting outbreaks.[35]

In the wake of SARS, the WHO dramatically overhauled the International Health Regulations in order to better cope with the weakest-link problem posed by the threat of emerging diseases.[36] As a result, the WHO no longer needs to rely exclusively on state reporting and can utilize other sources of data, including information from non-state actors who are now integrated into the treaty's surveillance functions.[37] In addition, national governments are now obligated to report "all events that may constitute a public health emergency of international concern."[38] The regulations include an affirmative obligation for states to develop and maintain the capacity to detect, assess, and report new epidemics.[39] Despite

33. World Health Organization [WHO], *Constitution of the World Health Organization*, art. 21, para. (a), July 22, 1946, 14 U.N.T.S. 185.

34. Fidler, *supra* note 16, at 801.

35. Jeremy Youde, *Mediating Risk Through the International Health Regulations and Bio-Political Surveillance*, 59 POL. STUD. 813, 817 (2011).

36. David P. Fidler & Lawrence Gostin, *The New International Health Regulations: An Historic Development for International Law and Public Health*, 34 J. L. MED. & ETHICS 85, 86 (2006).

37. David P. Fidler, *Revision of the World Health Organization's International Health Regulations*, ASIL INSIGHTS (April 2004), http://www.asil.org/insigh132.cfm.

38. World Health Assembly [WHA], *Revision of the International Health Regulations*, WHA Res. 58.3, art. 6 (May 23, 2005).

39. Michael Baker & David P. Fidler, *Global Public Health Surveillance Under New International Health Regulations*, 12 EMERGING INFECTIOUS DISEASES 1058, 1060 (2006).

these improvements, the first major test of the new regulations, in 2009, was less than a resounding success.[40]

The challenge of financing the global response to pandemic flu reflects the characteristics of an aggregate effort global public good. While much of the global focus to date has been on surveillance and reporting, less attention has been given to the role of treatment in slowing or containing an emerging pandemic.[41] Recent research has found that important spillover benefits exist for flu treatments, which create some incentive for wealthy countries to pay for treatment in low-income countries.[42] While the most cost-effective approach would be for wealthy countries to provide medicines only to countries in which there is an active outbreak, this might not be feasible in a fast-moving pandemic and contributions to countries in proportion to their population could also be cost-effective.[43] A further challenge raised by the prospect of treatment is that some countries, such as Indonesia, have previously refused to share virus samples with international authorities without guarantees they would receive an adequate supply of antivirals.[44] Although this dispute prompted new guidelines by the WHO, providing for the sharing of viruses and vaccines, there is still no clear obligation for any country to share treatments with another country.[45] Without a more effective aggregate effort to finance a global response, it is unlikely that the necessary level of global cooperation with respect to information sharing will be achieved.

Unlike surveillance and financing, the innovation required to combat pandemic flu has most closely reflected the characteristics of a single best-effort global public good. The WHO has limited capacity when it comes to supporting drug innovation and is even less able to respond as rapidly as required to develop new treatments to combat emerging flu strains. In contrast, the United States does have significant capacity to rapidly coordinate efforts to develop new treatments for flu and other emerging diseases. Its Project Bioshield involves a multi-billion dollar effort to foster

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40. Bradly Condon & Tapen Sinha, *Chronicle of a Pandemic Foretold: Lessons from the 2009 Influenza Epidemic* 1 (unpublished manuscript), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1398445.

41. *See, e.g.*, Frank Smith, *Look But Don't Touch: Overemphasis on Surveillance in Analysis of Outbreak Response*, 3 GLOBAL HEALTH GOVERNANCE (Spring 2010).

42. Georgiy V. Bobashev et al., *Policy Response to Pandemic Influenza* 4 (Nat'l Bureau of Econ. Res.Working Paper No. W17195, 2011).

43. *Id.* at 41-42.

44. Peter Gelling, *Indonesia Still Refusing to Share Bird Flu Samples*, N.Y. TIMES, Mar. 26, 2009, http://www.nytimes.com/2007/03/26/world/asia/26iht-web-0326-flu.5030534.html.

45. David P. Fidler & Lawrence O. Gostlin, *The WHO Pandemic Influenza Preparedness Framework: A Milestone in Global Governance for Health*, 306 J. AM. MED. ASS'N 200, 200-01 (2011).

innovation against a range of potential disease threats, including the development of flu vaccines and antiviral treatments.[46] Of course, the reliance on such a single best-effort to develop new treatments also highlights the related distributional challenges involved. Nonetheless, it seems unlikely in the near term that rapid innovation to confront new strains of the flu will be accomplished without such a single best-effort.

Pandemic flu reveals the limits of trying to categorize global health challenges as either single best-effort, aggregate effort, or weakest-link global public goods. Instead, the case study suggests a more promising approach: to view these categories as highlighting the unique challenges of innovation, financing, and compliance. It also suggests that despite the priority that many state actors place on global preparedness for pandemic flu, the first reports of a new strain are as likely to come from non-state actors as from leading states. Re-conceptualizing the categories of global public goods helps inform the approach and participants required at different stages of global public goods production.

III. RETHINKING GOVERNANCE FOR GLOBAL PUBLIC GOODS

As the specific case studies reveal, different strategies and institutions are required to respond to different stages of global public goods production. The challenge of innovation in the context of global health can often be accomplished through the efforts of a single country or a single actor. Financing for global health rarely requires the participation of all countries but usually depends upon contributions from a sufficient number of well-resourced countries. However, compliance often depends on nearly universal cooperation. New approaches to governance which take into account these discrete challenges are crucial to enhancing the provision of global public goods for health. While international institutions can overcome some of the coordination challenges involved in the production of global public goods, many of these institutions are not well placed to overcome the underlying free-rider problem. Incorporating non-state actors more fully into the governance of global health is one strategy that builds on their increasingly important role in the production of global public goods. Analyzing global health challenges through the lens of these different stages of global public goods production makes it clear how important non-state actors will be as part of the global response to health challenges.

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46. *See* FRANK GOTTRON, CONG. RESEARCH SERV., RS 21507, PROJECT BIOSHIELD: PURPOSES AND AUTHORITIES 7-8 (2009).

A. Innovation

Innovation is a major global health challenge because well-resourced countries and private-firms often lack sufficient incentive to make major investments in diseases which disproportionately affect people living in low-income countries. Non-state actors are becoming increasingly important in this realm with foundations providing critical early stage funding for the development of vaccines for many leading diseases. Yet neither current market incentives nor philanthropy have yet proven up to the challenge of fostering sufficient innovation when it comes to a wide range of infectious diseases. Of the nearly 1400 new medicines developed in the last quarter of the twentieth century, only one percent of these were drugs which responded to tropical diseases or tuberculosis.[47]

The development of new malaria treatments reflects the crucial role for a "single best-effort" in the realm of innovation and drug development. To respond to the growing resistance of mosquitoes to existing treatments in Southeast Asia during the Vietnam War, the Chinese government employed 500 scientists over a period of fourteen years to identify a new treatment for malaria. Known as Project 523, the effort involved screening 40,000 known chemicals and searching sources from traditional medicine in rural China.[48] Ultimately, an herb that had been identified for its healing properties as far back as 168 B.C. was determined to quickly kill the parasites transmitted by malarial mosquitoes. The discovery proved to be a tremendous advance in the global response to malaria and is now used as standard treatment in combination with other slower acting drugs as part of the artemisinin combination therapy. Insecticide treated bed-nets similarly emerged from the efforts of national governments to reduce casualties from malaria during World War II.[49] However, both artemisinin therapy and insecticide treated bed-nets only became widely available in low-income

47. *See* Suerie Moon, *Medicines as Global Public Goods: The Governance of Technological Innovation in the New Era of Global Health*, GLOBAL HEALTH GOVERNANCE (Fall 2008/Spring 2009), http://www.ghgj.org/moon2.2medecinespublicgood.htm.

48. World Health Organization [WHO], *Ancient Chinese Anti-Fever Cure Becomes Panacea for Malaria: An Interview with Zhou Yiqing*, Bulletin of the World Health Organization, 87.10 (2010), *available at* http://www.who.int/bulletin/volumes/87/10/09-051009/en/.

In the United States, a parallel effort led by the Walter Reed Army Institute of Research to find new treatments for soldiers who were contracting malaria in Vietnam led to the development of mefloquine. *See* Christian Ockenhouse et. al., *History of US Military Contributions to the Study of Malaria*, 170 MILITARY MED. 12, 14 (2005).

49. Moon, *supra* note 47 at 4.

countries after new financing mechanism generated economies of scale which significantly drove down the unit costs of production.[50]

While the example of malaria reflects the potential and limits of government led innovation, non-state actors are also playing an increasingly significant role in shaping the direction of global health research. A recent analysis of funding for major drug development initiatives focused on neglected diseases found that foundations accounted for more than three-quarters all investments.[51] Non-state actors are also centrally involved in re-shaping the markets for many drugs in the developing world. Some of these actors are brokering long-term deals to lower the costs of medicines, while others helped to catalyze major generic producers to enter the market in the first place. The Gates Foundation alone invested nearly $12 billion overall in global health between 1994 and 2008.[52] One World Health, a drug development organization and the first non-profit pharmaceutical company in the United States, has contributed to new drugs now used against a range of infectious diseases.[53]

Ultimately, the underlying challenge to generating innovation in the context of global health is to better align the incentives that link investments with results. Smarter incentive systems for innovation in global health become all the more important in motivating the necessary single best-effort in a world in which diverse sets of actors are involved in innovation. The incentives for global health innovation could be enhanced through the adoption of new kinds of reward systems. For example, a health impact fund might increase incentives for innovators to develop medicines for some of the major killer diseases around the world by rewarding them on the basis of lives saved in exchange for low-cost distribution.[54] A closer alignment between investments in global health innovation and results is likely to be a critical feature of fostering future innovation.

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50. *See* Oliver Sabot, Response, *One More Reason to Fund the Global Fund*, 379 THE LANCET e25 to e26 (2012).

51. MARY MORAN, ANNE-LAURE ROPARS, JAVIER GUZMAN, JOSE DIAZ & CHRISTOPHER GARRISON, THE NEW LANDSCAPE OF NEGLECTED DISEASE DRUG DEVELOPMENT 34 (2005), *available at* http://www.policycures.org/downloads/The_new_landscape_of_neglected_disease_drug_development.pdf.

52. Moon, *supra* note 47 at 11.

53. *See Challenging Models-Changing Minds*, ONE WORLD HEALTH, http://www.oneworldhealth.org/history (last visited Feb. 25, 2012).

54. Amitava Banerjee, Aidan Hollis & Thomas Pogge, *The Health Impact Fund: Incentives for Improving Access to Medicines*, 375 THE LANCET 166 (2010).

B. Financing

Despite important progress over the last decade, the challenge of global health financing remains a major obstacle to the provision of global public goods and a challenge of aggregate effort, since it is rare that a single nation can or will invest the resources needed to generate an adequate supply of global public goods. At the same time, this aggregate effort increasingly involves diverse types of actors. The polio eradication campaign points to the direct role of non-state actors in global health financing, with the Rotary Club becoming one of the largest contributors overall to the effort and the Gates foundation emerging as a leading contributor in recent years.[55] Just as important as this direct role in financing is the indirect role of non-state actors in catalyzing resource commitments by national governments. For example, the success of the Global Alliance for Vaccines and Immunization (GAVI) in resource mobilization reflects, in part, the strong sense of ownership by diverse stakeholders that has been fostered through their participation in the governance of GAVI.[56] With the slow growth of development assistance for global health challenges, which doubled between 2001 and 2008,[57] new financing mechanisms are likely to become increasingly important in delivering global public goods. A range of innovative financing mechanisms have emerged over the last decade to finance global public goods for health, but most of these mechanisms still require an aggregate effort. One innovative approach to financing eradication campaigns is through debt-swaps, in which countries that expand their immunization coverage are rewarded with lower levels of debt. The buy-down arrangement for polio eradication by the World Bank made a real contribution to ensuring the stable supply of vaccines in that country and to increasing levels of population immunity.[58]

While the exact mechanisms vary, most current approaches to financing global public goods for health remain essentially voluntary. In some cases, these contributions are treated as assessments or dues, based on a fair share calculation, but nearly all investments by national governments

55. Dan Nielsen, *The Global and Local Dimension*, *in* INNOVATION IN STRATEGIC PHILANTHROPY: LOCAL AND GLOBAL PERSPECTIVES 139, 141-43 (Anheier et. al. eds., 2007).

56. *See* Kenneth Abbott & David Gartner, *Reimagining Participation in International Institutions*, J. INT'L L. & INT'L REL (2012).

57. INST. FOR HEALTH METRICS & EVALUATION, University of Washington, FINANCING GLOBAL HEALTH 2011: Continued Growth as MDG Deadline Approaches 7 (2011).

58. Muhammad Ali Pate, *IDA Credit Buy-Down for Polio Eradication in Nigeria* (2010) (Apr. 2, 2012, 7:18 PM), http://www.fininnov.org/img/pdf/19%20-IDA%20buydowns%20Nigeria.pdf.

in delivering global public goods for health are still voluntary.[59] One mechanism which has moved beyond discretionary financing is UNITAID, which relies on designated airline taxes implemented at the national level to generate resources.[60] Shipping and aviation fuel taxation has also been put forward as an approach to financing global public goods for health that would be less subject to the fluctuations in donor contributions.[61] While distinct from the current voluntary mechanisms for mobilizing resources for global health, even these innovative mechanisms would still require the aggregate effort of a wide range of countries implementing these policies in order to be effective. The central challenge for global health financing is to move from purely voluntary mechanisms of fostering aggregate effort to more automatic mechanisms that catalyze adequate financing to deliver global public goods.

C. Compliance

One of the most difficult obstacles to delivering global public goods for health is the challenge of securing nearly universal compliance. When it comes to the surveillance and reporting of emerging diseases, the new International Health Regulations continue to lack effective enforcement mechanisms. In the global health context, there is no significant international capacity to impose costs for non-compliance within current legal and institutional arrangements. Nor are there mechanisms for individual states to enforce obligations through self-help, as is sometimes the case in other sectors. The challenge of compliance when it comes to global public goods for health remains a weakest-link problem in which new sources of pressure are often required to foster cooperation.

In the absence of centralized tools that foster universal compliance, decentralized strategies often become the last line of global defense. The challenge of compliance in delivering global public goods for health depends upon the capacity of a wide range of actors to increase the costs to states of non-compliance and to help overcome resistance among sub-national actors. Reaching universal compliance requires cooperation that extends to the level of local communities, to non-state actors, and even to individuals. Decentralized disease surveillance can serve as an important

59. *See* Richard Smith et. al. *Communicable Disease Control: A Global Public Good Perspective*, 19 HEALTH POL'Y & PLAN. 271, 275 (2004).

60. *How Innovative Financing Works*, UNITAID (2007), http://www.unitaid.eu/en/about/innovative-financing-mainmenu-105/163 (last visited Feb.25, 2012).

61. BILL GATES, INNOVATION WITH IMPACT: FINANCING 21ST CENTURY DEVELOPMENT 14 (2011).

global first warning system in the absence of effective state compliance with reporting requirements.

Increased involvement by non-governmental organizations responding to the challenge of disease surveillance is extremely valuable in fostering decentralized compliance. The involvement of non-state actors has proven quite important to increasing rates of polio immunization; community participation was crucial to the acceptance of polio vaccines by parents in India and contributed to the decline of cases in northern Nigeria beginning in 2007.[62] The weakest-link challenge in global health requires a decentralized approach to governance through which diverse actors can contribute directly to disease surveillance and catalyze states and sub-national actors to cooperate in implementing global health interventions.

CONCLUSION

The concept of global public goods offers a useful frame for analyzing a range of pressing global health challenges. The categories of weakest-link, single best-effort, and aggregate effort global public goods reveal distinct obstacles involved in responding to emerging infectious diseases and eradicating major diseases. Yet these categories are less helpful in differentiating particular global health challenges than they are in highlighting different dimensions or stages of these challenges. Innovation in the global health context is primarily a single best-effort problem, global health financing is usually an aggregate effort challenge, and compliance generally reflects a weakest-link problem. The recognition that different dimensions of global health challenges require distinct approaches suggests that diverse models of governance may be necessary to ensure the provision of global public goods for health. Innovation requires a better alignment of incentives with results, financing increasingly depends upon creating more automatic mechanisms for capturing resources, and compliance demands more decentralized means of enforcement.

While global health is the focus here, it is plausible that these stages of innovation, financing, and compliance could usefully be applied to other types of global public goods as well. For example in the climate context, it is likely that innovation, in areas such as geo-engineering, will reflect a single best-effort. However, the financing of a comprehensive response to climate change will surely be a challenge requiring an aggregate effort. While the overall challenge of compliance mitigating greenhouse gases has sometimes been framed as an aggregate effort problem, it could also be

62. ELISHA RENNE, THE POLITICS OF POLIO ERADICATION IN NORTHERN NIGERIA 34 (2010).

viewed as a weakest-link problem since it likely requires the participation of all the major emitters to be successful. Without the involvement of both China and the United States no climate agreement has much chance of ultimate success regardless of the aggregate effort of other nations.

In applying the concept of global public goods to contemporary global challenges, existing tools of analysis can be applied in innovative ways in order to better understand the key challenges involved in innovation, financing, and compliance. At each key stage, non-state actors are transforming the landscape of global public goods production and highlighting the need for new forms of governance. Contrary to the conventional wisdom that wider participation is an obstacle to effective collective action, incorporating a wider range of stakeholders can strengthen the global capacity to deliver global public goods.