

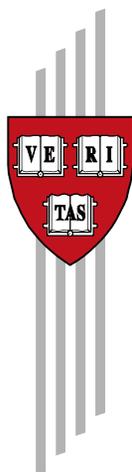
The Global Health System: Institutions in a Time of Transition

William C. Clark, Nicole A. Szlezak, Suerie Moon,
Barry R. Bloom, Gerald T. Keusch,
Catherine M. Michaud, Dean T. Jamison,
Julio Frenk, and Wen L. Kilama

CID Working Paper No. 193
January 2010

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Working Papers

Center for International Development
at Harvard University



Boston University School of Public Health



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The Global Health System: Institutions in a Time of Transition

William C. Clark, Nicole A. Szlezak, Suerie Moon, Barry R. Bloom, Gerald T. Keusch, Catherine M. Michaud, Dean T. Jamison, Julio Frenk, and Wen L. Kilama

Abstract

The global health system is in a period of rapid transition, with an upsurge of funds and greater political recognition, a broader range of health challenges, many new actors, and the rules, norms and expectations that govern them in flux. The traditional actors on the global health stage—most notably national health ministries, the World Health Organization (WHO) and a relatively small group of national medical research agencies and foundations funding global health research—are now being joined (and sometimes challenged) by a variety of newer actors: civil society and nongovernmental organizations, private firms, and private philanthropists, and an ever-growing presence in the global health policy arena of low- and middle-income countries, such as Kenya, Mexico, Brazil, China, India, Thailand, and South Africa.

We present here a series of four papers on one dimension of the global health transition: its changing institutional arrangements. We define institutional arrangements broadly to include both the actors (individuals and/or organizations) that exert influence in global health and the norms and expectations that govern the relationships among them.

We focused on three central questions regarding the global health system: (1) What functions must an effective global health system accomplish? (2) What kind of institutional arrangements can better govern the growing and diverse set of actors in the system to ensure that those functions are performed? (3) What lessons can be extracted from analysis of historical experience with malaria to inform future efforts to address them and the coming wave of new health challenges?

Keywords: global health, global governance, health innovation, health systems, malaria

JEL subject codes: H87, I10, I18, I19, O19, O30

Citation and Acknowledgements

This paper may be cited as:

Clark, William C., Nicole A. Szlezak, Suerie Moon, Barry R. Bloom, Gerald T. Keusch, Catherine M. Michaud, Dean T. Jamison, Julio Frenk, and Wen L. Kilama. "The Global Health System: Institutions in a Time of Transition." CID Working Paper No. 193. Center for International Development at Harvard University. January 2010.

It is available at <http://www.hks.harvard.edu/centers/cid/publications/faculty-working-papers/cid-working-paper-no.-193>. Comments are welcome and may be directed to the lead author, William C. Clark, william_clark@harvard.edu.

Support of the HKS Acting in Time Initiative is gratefully acknowledged.

The views expressed in this paper are those of the author and do not necessarily reflect those of the Center for International Development, of the HKS Acting in Time Initiative, of the John F. Kennedy School of Government, or of Harvard University. The Working Papers are produced to elicit feedback and to encourage debate on important public policy challenges. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Foreword

The research reported here was carried out under the “Acting in Time” initiative that we launched in 2007 at the Harvard Kennedy School. The initiative grew from the observation that virtually all of the world’s most pressing problems, from climate change to health care to natural disasters to disease outbreaks to demographic change to terrorist threats, were relatively easy to see coming and would be far easier to deal with if peoples acted sooner rather than later. Yet in virtually every case, nations and institutions seemed unable or unwilling to “act in time.” The initiative harnesses the capabilities of Harvard and its collaborators with the goal of understanding why particular problems are not being addressed and helping to foster ideas for effective solutions. Our hope and expectation is that by bringing together scholars of different backgrounds along with practitioners, we can learn more about the qualities of analysis, governance, policy design, democratic institutional structure, information, political mobilization, and leadership that can lead to effective and timely action.

Several of the projects begun under the initiative have already produced a variety of workshops, publications and outreach activities, documented on our “Acting in Time” web site <http://www.hks.harvard.edu/about/admin/offices/dean/acting-in-time>. I am delighted that this publication now adds to that collection, with the principle results of our project on “Institutions for bridging the knowledge-action gap in public health.” This project was carried out as a joint activity of the Harvard Kennedy School, the Harvard School of Public Health, and the Boston University School of Public Health. For its work in shepherding the project to conclusion, I am particularly grateful to its steering committee, consisting of William Clark, Nicole Szlezak, Suerie Moon, Barry Bloom, Gerald Keusch, Catherine Michaud and Dean T. Jamison.

The ideas found in this publication all illustrate the vital importance of the health issues that global institutions face, the critical benefits of acting promptly, and both the challenges and opportunities to do so. I would hope that these papers would provide both the impetus to act and the optimism that we can find a way to do so.

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The Global Health System: Institutions in a Time of Transition
*Four-part series in the Public Library of Science (PLoS) Medicine, January 2010**

Executive Summary

The global health system is in a period of rapid transition, with an upsurge of funds and greater political recognition, a broader range of health challenges, many new actors, and the rules, norms and expectations that govern them in flux. The traditional actors on the global health stage—most notably national health ministries, the World Health Organization (WHO) and a relatively small group of national medical research agencies and foundations funding global health research — are now being joined (and sometimes challenged) by a variety of newer actors: civil society and nongovernmental organizations, private firms, and private philanthropists, and an ever-growing presence in the global health policy arena of low- and middle-income countries, such as Kenya, Mexico, Brazil, China, India, Thailand, and South Africa.

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The introductory article of this series (Szlezák et al.) lays out some of the many challenges facing the global health system. The second article (Frenk) reflects on the essential characteristics of functioning national health systems, which are the anchoring institutions of the global health system. The third article (Keusch et al.) analyzes the institutional evolution of one of the system's most important functions—the integration of research, development, and delivery of health interventions.

* 1. Szlezák, Nicole A., Barry R. Bloom, Dean T. Jamison, Gerald T. Keusch, Catherine Michaud, Suerie Moon, William C. Clark. 2010. The global health system: Actors, norms and expectations in transition. *Public Library of Science Medicine*. 7(1):e1000183, <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000183>;

2. Frenk, Julio. 2010. The global health system: Strengthening national health systems as the next step for global progress. *Public Library of Science Medicine*. 7(1):e1000189, <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000089>;

3. Keusch, Gerald T., Wen Kilama, Suerie Moon, Nicole A. Szlezák, Catherine Michaud. 2010. Global health system: Linking knowledge with action -- learning from malaria. *Public Library of Science Medicine*. 7(1):e1000179, <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000179>;

4. Moon, Suerie, Nicole A. Szlezák, Catherine Michaud, Gerald T. Keusch, Dean T. Jamison, William C. Clark, Barry R. Bloom. 2010. The global health system: Lessons for a stronger institutional framework. *Public Library of Science Medicine*. 7(1):e1000193, <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000193>

The series concluded (see fourth article, Moon et al.) that an effective global health system must accomplish at least five core functions: agenda-setting; financing and resource allocation; research and development (R&D); implementation and delivery; and monitoring, evaluation, and learning. Ensuring that these functions are performed requires the following:

- In the present complex global environment no single actor can or should set the agenda for action. Broad-based, participatory, transparent processes for agenda setting, anchored by WHO's global political legitimacy and adhering to widely-accepted procedural principles, will be required to define priorities, avoid unnecessary duplication, and share knowledge.
- Sustainability depends on strengthening national health systems. Donors should allow greater flexibility for recipient countries to direct a portion of received funds beyond narrow programmatic interventions to strengthening national health systems.
- Ironically, the proliferation of global actors threatens to weaken health systems by placing additional reporting burdens on already thinly stretched health ministries. By channeling multiple funding streams into a single source for HIV/AIDS, tuberculosis, and malaria, the GFATM offers an instructive example of how to distribute the resources of various donors in a way that is sensitive to national health systems' priorities and constraints. As new global health initiatives arise to address the wave of emerging health challenges, the global health system should identify and adopt analogous ways to streamline reporting and, more generally, to minimize the additional transaction costs put on countries.
- Basic and translational research and research capacity-building involving strong and long-term collaborations between technically advanced research institutions and emerging centers of excellence in disease endemic countries are essential components of a well functioning global health system.
- Systematic investment in creating new and improving existing M&E programs should become second nature for all global health activities. Over time, this investment – if adequately financed – will contribute to building robust M&E systems and to generating reliable, comparable data to inform action.
- The global health system should prioritize additional investments in longer-term, multidisciplinary education and training at many levels (e.g., national, provincial, district), which can result in large payoffs for improved health.
- Finally, it will be critical to support research that provides the evidence and knowledge bases for prioritization, resource allocation, and the development and evaluation of new tools and interventions. Furthermore, research should be promoted to understand variation in the performance of different national health systems, and thus to identify system designs that can be adapted to local circumstances to help translate global aspirations into meaningful impact on people's lives.

The Global Health System: Actors, Norms, and Expectations in Transition

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This is the first in a series of four articles that highlight the changing nature of global health institutions.

The Global Health System: A Time of Transition

The global health system that evolved through the latter half of the 20th century achieved extraordinary success in controlling infectious diseases and reducing child mortality. Life expectancy in low- and middle-income countries increased at a rate of about 5 years every decade for the past 40 years [1]. Today, however, that system is in a state of profound transition. The need has rarely been greater to rethink how we endeavor to meet global health needs.

We present here a series of four papers on one dimension of the global health transition: its changing institutional arrangements. We define institutional arrangements broadly to include both the actors (individuals and/or organizations) that exert influence in global health and the norms and expectations that govern the relationships among them (see Box 1 for definitions of the terms used in this article).

The traditional actors on the global health stage—most notably national health ministries and the World Health Organization (WHO)—are now being joined (and sometimes challenged) by an ever-greater variety of civil society and nongovernmental organizations, private firms, and private philanthropists. In addition, there is an ever-growing presence in the global health policy arena of

low- and middle-income countries, such as Kenya, Mexico, Brazil, China, India, Thailand, and South Africa.

Also changing are the relationships among those old and new actors—the norms, expectations, and formal and informal rules that order their interactions. New “partnerships” such as WHO’s Roll Back Malaria Partnership (RBM), Stop TB, the Global Alliance for Vaccines and Immunization (GAVI), the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), and many others have come to exist alongside and somewhat independently of traditional intergovernmental arrangements between sovereign states and UN bodies (see Figures 1 and 2 for an illustration of the underlying governance principles). These partnerships have been emphasized—not least by WHO itself—as the most promising form of collective action in a globalizing world [2]. Large increases in international support for the newer institutions has led to relative and, in some cases, absolute declines in the financial importance of traditional actors [3].

The rise of multiple new actors in the system creates challenges for coordination

but, more fundamentally, raises tightly linked questions about the roles various organizations should play, the rules by which they play, and who sets those rules. Actors may exercise power within the constraints of international institutions in hopes of achieving benefits and shared objectives [4]. Such a calculus helps to explain why actors are willing to fund multilateral initiatives such as WHO, GFATM, RBM, and Stop TB, despite the fact that doing so entails relinquishing considerable control over what is done with their resources. On the other hand, powerful and financially independent actors, such as national governments, may elect to use their resources to influence the outcomes from multilateral initiatives or create bilateral ones. The lack of a clear set of rules that constrain distortion of priorities by powerful actors can threaten less powerful ones. As a case in point, despite widespread support for its overarching goals, there is considerable discussion, in some cases even unease and some tension, around the prominent role played by the Bill & Melinda Gates Foundation, whose spending on global health was

Citation: Szlezák NA, Bloom BR, Jamison DT, Keusch GT, Michaud CM, et al. (2010) The Global Health System: Actors, Norms, and Expectations in Transition. *PLoS Med* 7(1): e1000183. doi:10.1371/journal.pmed.1000183

Academic Editor: Gill Walt, London School of Hygiene and Tropical Medicine, United Kingdom

Published: January 5, 2010

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Funding: This work was supported by a grant to the Institutional Innovations in Global Health project by the John F. Kennedy School of Government at Harvard University, Cambridge, Massachusetts, United States, under its “Acting in Time” program. Additional support was received from the Burroughs Wellcome Fund, Research Triangle Park, North Carolina, United States. The funders had no role in the decision to publish or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

Abbreviations: GAVI, Global Alliance for Vaccines and Immunization; GFATM, Global Fund to Fight AIDS, Tuberculosis and Malaria; M&E, monitoring and evaluation; R&D, research and development; RBM, Roll Back Malaria Partnership; WHA, World Health Assembly; WHO, World Health Organization.

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Provenance: Commissioned, externally peer reviewed.

The Policy Forum allows health policy makers around the world to discuss challenges and opportunities for improving health care in their societies.

Box 1. Defining the Global Health System

We understand global health needs to include disease prevention, quality care, equitable access, and the provision of health security for all people [16–18]. We define the global health system as the constellation of actors (individuals and/or organizations) “whose primary purpose is to promote, restore or maintain health” [19], and “the persistent and connected sets of rules (formal or informal), that prescribe behavioral roles, constrain activity, and shape expectations” [20] among them. Such actors may operate at the community, national, or global levels, and may include governmental, intergovernmental, private for-profit, and/or not-for-profit entities.

almost equal to the annual budget of WHO in 2007 [5–8].

Finally, this period of transition in actors and relationships comes at a time when the very nature of the challenges faced by health systems is itself being transformed. The success of child survival efforts has meant that noncommunicable diseases, including cardiovascular disease, cancer, diabetes, and neuropsychiatric disease, are growing in prevalence alongside the continuing threats of communicable diseases [9–11]. The globalizing economy poses a new set of health challenges as the rules that govern trade in goods, services, and investment reach more deeply into national regulatory and health systems than have previous trade arrangements [12,13]. Finally, changes in climate and other environmental variables are likely to create unexpected and unpredictable health threats, both as a direct result of changing environments for disease

vectors and as an indirect result of impacts on water and food security, extreme events, and increased migration [14,15].

The melee resulting from these interacting transitions has produced some extraordinary success stories, such as the drive that dramatically increased access to lifesaving antiretroviral therapy for people living with HIV/AIDS, unprecedented access to insecticide-treated bednets for malaria, and enhanced access to anti-TB drugs in the developing world within a span of a few short years. But there is also mounting concern that the increasingly complex nature of the evolving global health system leaves unexploited significant opportunities for improving global health, results in duplication and waste of scarce health resources, and carries high transaction costs. The ongoing global financial crisis makes the efficient and effective performance of the global health system all the more pressing.

Many have expressed doubts that today’s global health system is remotely adequate for meeting the emerging challenges of the 21st century [21–24]. A groundswell of opinion [25–35] suggests that new thinking is needed on whether or how practical reform of the present complex global health system can improve its ability to deal with such key issues as:

- Setting global health agendas in ways that not only build upon the enthusiasm of particular actors, but also improve the coordination necessary to avoid waste, inefficiency, and turf wars.
- Ensuring a stable and adequate flow of resources for global health, while safeguarding the political mobilization that generates issue-specific funding. How can the global burden of financing be equitably shared, and who decides? How should resources be allocated to meet the greatest health risks, particularly those that lack vocal advocates?
- Ensuring sufficient long-term investment in health research and development (R&D). Who should contribute, and who should pay? How can the dynamism and capacity of both public and private sectors from North and South be harnessed, without compromising the public sector’s regulatory responsibilities?

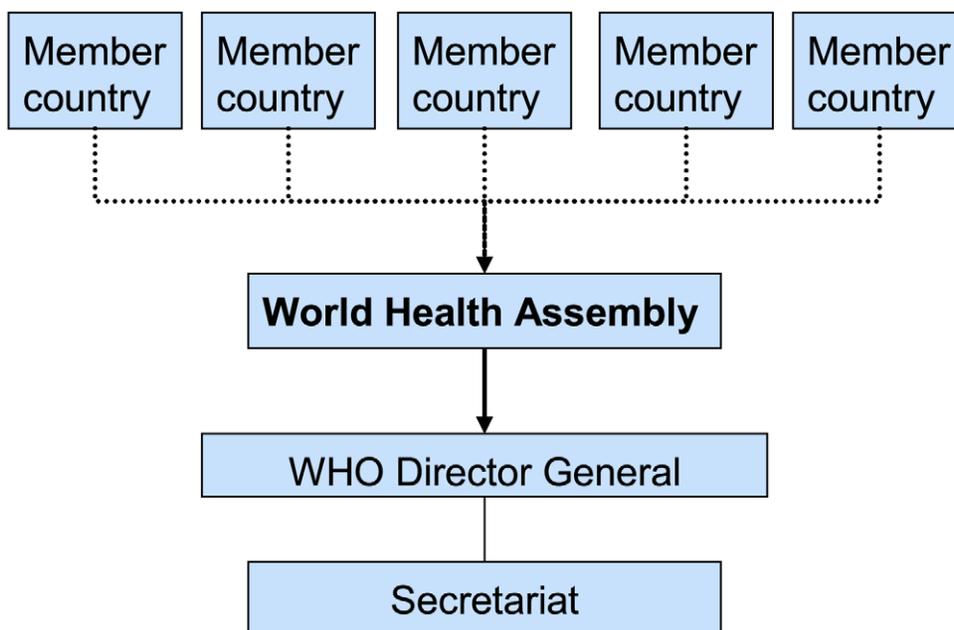


Figure 1. UN-type international health governance. Based on the principles of the UN system, member countries are represented in the World Health Assembly (WHA), which functions as the central governing body. The WHA appoints the director general, oversees all major organizational decision making and approves the program budget. doi:10.1371/journal.pmed.1000183.g001

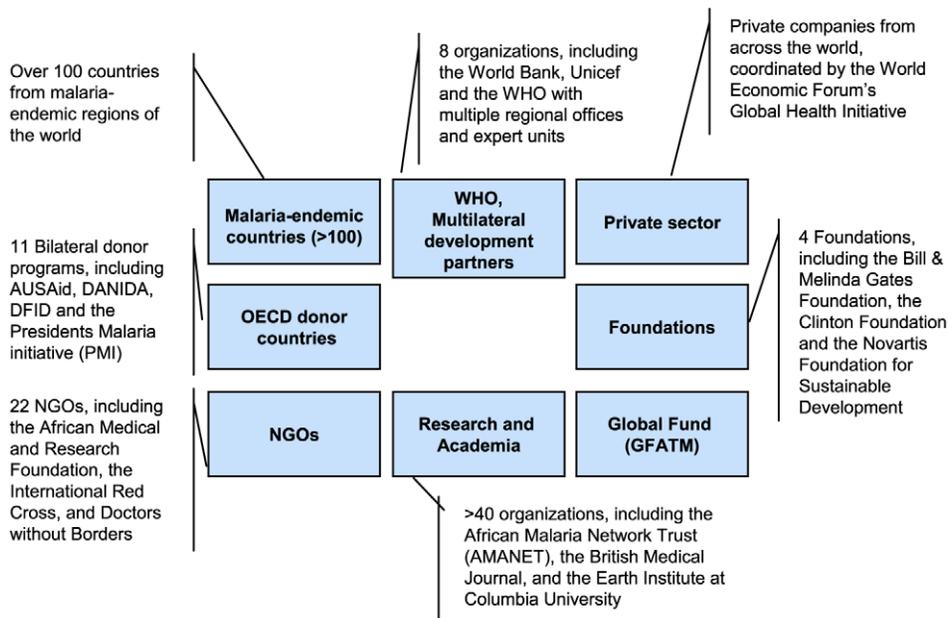


Figure 2. Global Health as partnership. Today's Roll Back Malaria Partnership consists of more than 500 partners, including the major players WHO, the Global Fund, and the Bill & Melinda Gates Foundation. RBM was initiated in 1998 by WHO, UNICEF, UNDP, and the World Bank. WHO currently hosts RBM's secretariat and contributes in multiple ways. However, it is not presented as the central node of the partnership (source: <http://www.rollbackmalaria.org/>). doi:10.1371/journal.pmed.1000183.g002

- Creating mechanisms for monitoring and evaluation and judging best practices—how can policy agreement be achieved when actors bring contested views of the facts to the table?
- Learning lessons from the enormous variance in effectiveness and costs of various national and international health systems, from R&D to the delivery and monitoring and evaluation (M&E) of interventions in the field, to create improvements everywhere.

Roadmap of the Series

In this series we undertook a study of the role of institutions in the global health system. The aims of the study were threefold: first, to advance current understanding of the interplay of actors in the system; second, to evaluate its performance; and third, to identify opportunities for improvement. The project was part of a larger program led by Harvard University's John F. Kennedy School of Government to advance thinking on the challenges of linking research knowledge with timely and effective action in an increasingly globalized and diverse world [36,37]. It drew together theoretical literature on global governance that has emerged from the field of international relations over the last half-century [20,38,39]; on empirical analysis of institutional design and perfor-

mance in other sectors that, similar to public health, seek to mobilize scientific knowledge as a global public good (e.g., agriculture and environmental protection [40–42]); and on the engagement of several of the authors of this paper in contemporary policy debates on ways to improve the institutions that promote global health [43,44].

We focused on three central questions regarding the global health system: (1) What functions must an effective global health system accomplish? (2) What kind of arrangements can better govern the growing and diverse set of actors in the system to ensure that those functions are performed? (3) What lessons can be extracted from analysis of historical experience with malaria to inform future efforts to address them and the coming wave of new health challenges? To illuminate these questions, we built a series of case studies, workshops, and synthesis efforts, the results of which are reported in more detail elsewhere (<http://www.cid.harvard.edu/sustsci/events/workshops/08institutions/index.html>).

In the papers presented in this series we summarize representative results from our work for one key actor in, and one key function of, the global health system. Thus, the second article in the series, by Frenk [45], reflects on the essential characteristics of functioning national health systems, which are the anchoring

institutions of the global health system. The continued crucial importance of national health systems as connectors of research and development with populations, and as guarantors of the successful and sustained delivery of health interventions to people and populations, is often overlooked in enthusiastic discussions of new approaches to the architecture of global health. Indeed, the biggest challenge facing global health today is to reconcile the ongoing global-level transformation with the need to further strengthen and support national-level health systems.

The third article, by Keusch et al. [46], examines how the global health system has evolved to better integrate the research, development, and delivery of health interventions—a core function of the system. We chose the global response to malaria as a good case study because of the long history of global efforts to combat the disease, multiple attempts at institution building in this domain, its recent rise on the global agenda, and the concomitant increase in resources devoted to combating it. Many old and new approaches have evolved and been tested in the field of malaria, including targeted programs like WHO's Malaria Action Programme and the WHO/UNDP/Unicef/World Bank Training in Tropical Diseases (TDR) Programme; governance partnerships like RBM; product development partnerships

such as the Medicines for Malaria Venture; and new delivery mechanisms such as GFATM. Goals have oscillated between global eradication, regional and national control, and now perhaps back to global eradication. Exploration of the evolution of institutional arrangements linking malaria research, development, and delivery hold important lessons for understanding the global health system more generally.

The fourth article of the series, by Moon et al. [47], presents conclusions regarding the three central questions raised above and poses questions for further research and recommendations for future action.

Our hope is that this series stimulates debate, encourages further case studies, and provides insights into general principles for the improvement of the global health system.

Author Contributions

ICMJE criteria for authorship read and met: NAS BRB DTJ GTK CMM SM WCC. Wrote the first draft of the paper: NAS. Contributed to the writing of the paper: NAS BRB DTJ GTK CMM SM WCC. Co-PI: NAS. Conceptualized the study: NAS WCC. Organized the meetings: BRB WCC. PI on the grant that supported the project: WCC. Chaired the steering group for the project: WCC. Supervised the research: WCC.

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The Global Health System: Strengthening National Health Systems as the Next Step for Global Progress

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This is the second in a series of four articles that highlight the changing nature of global health institutions.

Three circumstances make the present moment unique for global health. First, health has been increasingly recognized as a key element of sustainable economic development [1], global security, effective governance, and human rights promotion [2]. Second, due to the growing perceived importance of health, unprecedented—albeit still insufficient—sums of funds are flowing into this sector [3]. Third, there is a burst of new initiatives coming forth to strengthen national health systems as the core of the global health system and a fundamental strategy to achieve the health-related Millennium Development Goals.

In order to realize the opportunities offered by the conjunction of these unique circumstances, it is essential to have a clear conception of national health systems that may guide further progress in global health. To that effect, the first part of this Policy Forum examines some common misconceptions about health systems. Part two explains a framework to better understand this complex field. Finally, I offer a list of suggestions on how to improve national health system performance and what role global actors can play.

The Health System: Neither Black Box Nor Black Hole

The increasing interest in national health systems signals a positive shift. As funding for global health has grown during the past years, it has become increasingly clear that this is a necessary but not sufficient condition for progress. Resources should also be used effectively to produce the expected results. In a virtuous circle,

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those results will help to maintain the momentum of increased funding for health.

Achieving results is precisely what defines health system performance. So if we are to advocate for greater resources, we also need to improve our understanding of these systems. Three common misconceptions are particularly prevalent, which see the health system as a black box, as a black hole, or as a laundry list.

The “black box” misconception is the belief that things are too complicated and we do not understand the intricate mechanisms of health systems, so we must simply get technologies and other inputs in place and then outputs will somehow work their way. Yet we have built a sufficient body of knowledge to be able to open the black box and devise specific interventions to improve the performance of the health system. There is a mounting body of evidence on what works and what doesn’t in different settings.

The “black hole” misconception is the common view that no amount of money will suffice to achieve the desired results. As with the dreaded astronomical bodies, health systems absorb enormous amount of energy, but no light comes out of them. Yet, we know that some systems are much more efficient in achieving better results with limited resources.

Finally, the “laundry list” view is a sort of “inventory” approach, in which the health system is defined as a mere list of the different organizations or persons that participate in producing health services, without requiring that such components be coordinated or integrated.

Expanding Our View on Health Systems

Part of the problem with the health systems debate is that too often it has adopted a reductionist perspective that ignores important aspects. Developing a more comprehensive view requires that we expand our thinking in four main directions.

First, we should think of the health system not only in terms of its component elements (like human resources, financing, hospitals, clinics, technologies, etc.) but most importantly in terms of their interrelations. Second, we should include not only the institutional or supply side of the health system, but also the population. In a dynamic view, the population is not an external beneficiary of the system; it is an essential part of it. This is because, when it comes to health, persons play five different roles: (i) as patients, with specific needs requiring care; (ii) as consumers, with expectations about the way in which they

Citation: Frenk J (2010) The Global Health System: Strengthening National Health Systems as the Next Step for Global Progress. *PLoS Med* 7(1): e1000089. doi:10.1371/journal.pmed.1000089

Published: January 12, 2010

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Funding: This work was supported by a grant to the Institutional Innovations in Global Health project by the John F. Kennedy School of Government at Harvard University, Cambridge, Massachusetts, United States under its “Acting in Time” program. Additional support was received from the Burroughs Wellcome Fund, Research Triangle, North Carolina, United States. The funders had no role in the decision to publish or preparation of the manuscript.

Competing Interests: The author has declared that no competing interests exist.

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Provenance: Commissioned; externally peer reviewed. This paper is based on two keynote presentations delivered at the following meetings: (a) Meeting on “Global Health and the United Nations,” Carter Center, Atlanta, Georgia, May 8–9, 2008; (b) Workshop on “Institutions for Closing the Knowledge-Action Gap in Global Health,” John F. Kennedy School of Government, Harvard University, Cambridge, Massachusetts, June 11–13, 2008.

will be treated; (iii) as taxpayers and therefore as the ultimate source of financing; (iv) as citizens who may demand access to care as a right; and most importantly, (v) as co-producers of health through care seeking, compliance with prescriptions, and behaviors that may promote or harm one's own health or the health of others. The importance of this perspective is that it opens the door to population-side interventions to improve the health system, as evidenced by the successful experiences in Mexico and elsewhere with conditional cash transfers that provide incentives for health-promoting behaviors and with insurance programs that empower citizens by subsidizing their demand for explicit entitlements [4].

A third expansion of our understanding of systems refers to their goals. Typically, we have limited the discussion to the goal of improving health. This is, indeed, the defining goal of a health system. However, we must look not only at the level of health, but also at its distribution, which gives equity a central place in assessing a health system. In addition, we must also include other goals that are intrinsically valued beyond the improvement of health. One of those goals is to enhance the responsiveness of the health system to the legitimate expectations of the population for care that respects the dignity of persons and promotes their satisfaction. The other goal is fair financing, so that the burden of supporting the system is distributed in an equitable manner and families are protected from the financial consequences of disease.

Finally, we should expand our view with respect to the functions that a health system must perform. Most global initiatives have been concerned mainly with one of those functions, namely, the direct provision of services, whether they are medical or public health services. This is, of course, an essential function, but for it to happen at all, health systems must perform other enabling functions, such as stewardship, financing, and resource generation, including what is probably the most complex of all challenges, the health workforce.

The four directions I have just summarized form a framework [5] to expand our understanding of health systems so that we may improve them. Specifying the goals allows us to assess the performance of a health system by measuring how well each of the goals is achieved, given the level of health expenditure and the social determinants of health, as measured by indicators like income per capita or educational

level. In turn, analysis of the way the functions are carried out enables us to explain variations in performance.

A LIST for Health Systems Improvement

Actually, we know that there are wide variations in performance by different health systems, even at the same level of income per capita and health expenditure. These variations are due to the influence of several determinants enclosed in the acronym LIST, which stands for leadership, institutions, systems design, and technologies. These determinants are enumerated in decreasing order of complexity, from the bottom up.

Technologies

No health system can succeed if it does not deliver the appropriate set of interventions, along with their accompanying technologies. This is the aspect that has been better studied and where we have substantial consensus on priorities. Most of the recent increases in global-level support for countries has been directed to expanding the supply of drugs, vaccines, bed nets, and other technologies. However, to work at all these technologies must be embedded in the second element.

Systems Design

Quality services can only be delivered if a set of systems or subsystems (such as procurement, information, personnel, etc.) are designed so that the required structures and procedures can assure the timely conjunction of human, financial, technological, and knowledge resources. One positive aspect of the recent global initiatives on health systems strengthening is that they address many of these crucial issues. But it is also necessary to take the next step in our acronym.

Institutions

Development is only possible through the patient construction of institutions, which represent the vehicles whereby human beings mobilize their talents, values, and interests towards the pursuit of shared goals. Institutions also introduce certainty to transactions and articulate incentives. A crucial institution is the ministry of health. Despite its central importance for the stewardship function, many countries are far from having an optimal ministry of health. In this regard, there is a sharp contrast with ministries of finance, where the imperatives of globalization have imposed a fairly homogeneous level of technical proficiency across

countries. Ministries of health should certainly be sensitive to local realities, but there is a technical core that is increasingly connected to global networks and should therefore be strengthened through global efforts. Institution building is always tough because it requires long-term investments that are often obliterated by short-term political pressures. This problem is related to the last element in the LIST.

Leadership

Probably the most complex challenge in health systems is to nurture persons who can develop the strategic vision, technical knowledge, political skills, and ethical orientation to lead the complex processes of policy formulation and implementation. Without leaders, even the best designed systems will fail.

Knowledge and Action

The present moment offers a unique opportunity to advance specific proposals on each of the four elements of health systems strengthening: greater access to life-saving technologies, improvements in critical subsystems, long-term investments in institution building, and leadership development. However, for these investments to be successful, they must be linked to concrete health outcomes. In this respect, global health requires a new way of thinking and acting in order to bridge the traditional divide between the "vertical" approach, focusing on technical interventions for specific disease priorities [6], and the "horizontal" approach, aimed at strengthening the overall structure and functions of the health system but without a clear sense of priorities. The solution is a truly "diagonal" approach, whereby explicit intervention priorities are used to drive improvements of the health system [7].

Health systems are the main instrumentality to close the knowledge-action gap. To realize this potential, it will be necessary to mobilize the power of evidence to promote change. Yet all too often reform efforts are not evaluated adequately. Each innovation in health systems constitutes a learning opportunity. Not to take advantage of these opportunities condemns us to rediscover at great cost what is already known or to repeat past mistakes. For this reason, the current surge of initiatives on health systems strengthening must be accompanied, from the outset, by an effort to generate a process of shared learning among countries. There is an urgent need to build up a body of knowledge on what works and what does

not, so that each country is better equipped to adopt and adapt the lessons learned from every other nation. Shared learning would be greatly assisted by a global repository of evidence on health system performance [8].

This type of evidence is a global public good. Therefore, its funding and coordination requires international action, with

far more attention than it has received so far. It also requires a common framework for monitoring and evaluation of interventions that promotes comparability of data, transparency of methods, and accountability to the global community. In this way, knowledge and action will reinforce each other, bringing the world closer to the common goal of better health for all.

Acknowledgments

I am grateful to Octavio Gómez-Dantés and Lincoln Chen for valuable input into this paper.

Author Contributions

ICMJE criteria for authorship read and met: JF. Wrote the first draft of the paper: JF.

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The Global Health System: Linking Knowledge with Action—Learning from Malaria

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This is the third in a series of four articles that highlight the changing nature of global health institutions.

Introduction

Conducting basic research, translating it into the development of new health tools, and delivering products to patients in need of them are core functions of an effective global health system [1]. Yet performing these functions is a particular challenge for diseases that primarily affect the poor in low-income countries, partly because efforts to understand diseases and develop tools to combat them are often detached from efforts to deliver interventions. For malaria, the global health system has evolved over the past century to integrate better the research, development, and delivery (R&D&D) of new products to treat and control the disease. This article traces that evolution and extracts lessons applicable to the many new challenges currently facing the global health system.

Historically, global investment in malaria research has been disproportionately small relative to its disease burden. Research funding in endemic countries was seriously limited by resource and capacity constraints, while funding agencies in industrialized countries were primarily concerned with domestic health issues, with the important exception of military needs to control malaria. Recently, however, global malaria R&D investments have increased dramatically, from an estimated \$84 million in 1993 [2] to \$323 million in 2004 [3], with a new focus on malaria's impacts on people in endemic countries.

In malaria control, there has been a concomitant shift from time-limited, cen-

tralized efforts—often relying on single interventions—toward a more decentralized, continuous effort using multiple approaches. Malaria is no longer seen primarily as a biomedical problem, but rather as a complex ecological system in which humans, mosquitoes, and parasites are interconnected. Malaria has also increasingly been characterized as a “global” and regional rather than a national or local problem. This has led to changed concepts of governance. Such governance has changed in two ways: (1) from an essentially “top-down” process from international to national or local players to an active interplay between local and global players, and (2) from a system that centered on the World Health Organization (WHO), with little attention to national governments in endemic countries, to one in which state and non-state actors cooperate across multiple dimensions, emphasizing inclusion and engagement of local communities. Today, for the first time, the principal constraints to malaria control may be more political and managerial than financial or technical.

This article explores the changing global health system for malaria research and the delivery of research products to those at risk, including the organizations and actors involved, and the arrangements that govern their interactions (for more about these actors and arrangements, see the first article in this four-part series [1]). Following Alilio and colleagues [4], we have divided the evolution of malaria R&D&D into three periods (Table 1); although these divisions are somewhat arbitrary, they highlight major shifts in the system's development. Finally we address the lessons learned and speculate about the future.

Phase I. Late Nineteenth Century through the 1950s: National Public Goods R&D

The early driver of malaria research was the desire of the European colonial powers to protect their own nationals and the economic interests in their colonies. This investment led to many discoveries, in-

Citation: Keusch GT, Kilama WL, Moon S, Szlezák NA, Michaud CM (2010) The Global Health System: Linking Knowledge with Action—Learning from Malaria. *PLoS Med* 7(1): e1000179. doi:10.1371/journal.pmed.1000179

Academic Editor: Gill Walt, London School of Hygiene and Tropical Medicine, United Kingdom

Published: January 19, 2010

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Funding: This work was supported by a grant to the Institutional Innovations in Global Health project by the John F. Kennedy School of Government at Harvard University, Cambridge, Massachusetts (US) under its “Acting in Time” program. Additional support was received from the Burroughs Wellcome Fund, Research Triangle Park, North Carolina (US). The funders played no role in the decision to submit the article or in its preparation.

Competing Interests: The authors have declared that no competing interests exist.

Abbreviations: CDC, US Centers for Disease Control; DDT, dichloro-diphenyl-trichloroethane; DFID, Department for International Development (UK); DNDi, Drugs for Neglected Diseases Initiative; GFATM, Global Fund for AIDS, Tuberculosis and Malaria; GND, Great Neglected Diseases Biomedical Research Network; IoWH, Institute for One World Health, ITN, insecticide-treated bed net; MIM, Multilateral Initiative on Malaria; MMV, Medicines for Malaria Venture; MVI, Malaria Vaccine Initiative; NGO, non-governmental organization; NIH, US National Institutes of Health; PDP, Product Development Partnership; PEPFAR, President's Emergency Program for AIDS Relief; PMI, President's Malaria Initiative; R&D, research and development; R&D&D, research and development and delivery; RBM, Roll Back Malaria; UNICEF, United Nations Children's Fund; USAID, United States Agency for International Development; WHO, World Health Organization

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Provenance: Commissioned, externally peer reviewed.

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Table 1. Evolution of institutional arrangements for malaria R&D.

Phase	Purpose of R&D Institutions	Targeted End-Users	Funding	Targeted Diseases
I: Late Nineteenth Century through the 1950s	National public goods	Industrialized countries	Public, private	Malaria, yellow fever
II: 1960s–80s	International health programs (e.g., TDR, Fogarty International Center, Rockefeller Foundation)	Developing countries	Public, philanthropic	Malaria and other tropical infectious diseases
III: 1990s–2000s	Global health partnerships neglected disease R&D (e.g., PDPs)	Developing countries	Public, philanthropic, private sector	Malaria, tuberculosis, HIV/AIDS and neglected tropical infectious diseases
IV: The Future	Global public goods for global health	Global	Public, philanthropic, private sector	All types

doi:10.1371/journal.pmed.1000179.t001

cluding identification of the cause, vector, and transmission cycle of malaria. Later, when malaria debilitated allied soldiers in World War II (WWII), military needs drove malaria R&D. None of the principal malaria medicines of the twentieth century would have been discovered without military R&D [5–8]. Even insecticide-treated bed nets (ITNs) [9] and household spraying with DDT were used effectively by the allied militaries in WWII [6,10].

During this long period, innovation followed a distinct trickle-down pattern. Researchers in the North produced knowledge to serve their own national needs, and only later was it applied for the benefit of low-income countries. While these R&D efforts ultimately created global benefits, the institutions that guided and benefited from the research were in rich countries. The drawback for low-income countries was that tools developed for militaries of the North were not necessarily well-suited for civilians in the South. Cost was not a major issue for the North, and because antimalarial drugs were targeted at adults, testing in children was a low priority, although children account for most malaria deaths. As the US Military Infectious Diseases Research Program recently pointed out, “Preventing death in children and keeping soldiers healthy and effective are distinct goals requiring different research strategies” [11].

Delivery

The association between swamps, mosquitoes, and malaria has long been appreciated [12]. By the time of the Roman Empire, bed nets, decoy animals to attract mosquitoes, swamp drainage, and housing prohibitions in mosquito breeding areas were used to control malaria. The clustering of “marsh fever” among those living near smelly swamps led to the miasma theory of disease, that foul “mala aria” (bad air in Italian, from which the name malaria

derives) from decomposed matter (miasmas) was the cause. Efforts at control were local and often misguided, yet sometimes effective, for example drainage of swamps and closing of mill ponds in the US in the nineteenth century.

Evidence-based systematic attempts to control malaria at a population scale date from the beginning of the twentieth century, and were based on the understanding of the transmission cycle and recognizing quinine’s therapeutic value. Control programs were used in large, expensive works projects threatened by malaria (and yellow fever) and targeted at workers and managers from industrialized countries, such as the Suez and Panama Canal projects. Multiple strategies were adopted, including manual clearance of mosquito larvae, removal of breeding sites, leveling and oiling of roads to eliminate water pools, use of clothing to prevent mosquito bites at dusk, burning of pyrethrum indoors, larviciding with chemicals, treatment with quinine, use of window screens, and collection of indoor resting mosquitoes post-feeding. These strategies were effective in the limited scope of the effort. In the late 1930s, Fred Soper of the Rockefeller Foundation and 40,000 workers in Brazil successfully eradicated *Anopheles gambiae*, which had recently been imported, using pyrethrum spraying, larviciding with Paris Green (copper acetate-arsenite), and elimination of breeding sites [13].

In 1946, the US Centers for Disease Control (CDC) was established in Atlanta, Georgia as the successor to the WWII Malaria Control in War Areas Agency, primarily to eradicate malaria in the southern states. According to a history of the CDC, “Pursuit of malaria was by far the most absorbing interest of CDC during its early years, with over 50 percent of its personnel engaged in it” [14]. Malaria transmission in the US was eliminated.

Phase II. 1960s–1980s: The International Health Perspective

Phase I had involved nationally focused programs concerned with domestic social well-being (malaria in the southern US), economic gain (the canal projects), or military needs (wars in malaria zones). But subsequent years witnessed a phase of internationalization in public health, with rapid decolonization, the launch of national foreign aid initiatives amidst heightened Cold War tensions, and new faith in the potential of science and technology.

R&D

In phase II, the relevant actors were increasingly viewing the world as interdependent [15], with greater emphasis on international health needs. The Special Programme for Research and Training in Tropical Diseases (TDR) was established within WHO in 1975, and played a key role in building malaria research capacity in developing countries, particularly in Africa where few malaria researchers existed at the time of political independence for the former colonies. TDR also established international networks of academic centers for tropical disease research, a model that the public–private product development partnerships would later emulate [16]. These national–international partnerships proved to be essential for the development of critical new tools, including artemisinin combination therapy and ITNs still in use today [9,17,18]. During this era the private foundations reemerged as a force, for example the Great Neglected Diseases (GND) of Mankind Biomedical Research Network launched by Kenneth Warren of the Rockefeller Foundation [19]. Catalyzed by GND funds, a stream of young scientists from developing and developed nations were attracted to work with

established researchers in this global network on problems such as malaria in the laboratory and the field.

Compared to the previous period, institutions for R&D were broader in scope, more international, and targeted low-income country needs. However, as the Rockefeller Foundation's Tim Evans later noted, GND produced "improved basic knowledge about poorly understood tropical diseases...[but] no explicit strategy to translate new knowledge into drug or vaccine development" [20]. By the late 1980s the GND was winding down, TDR was seriously underfunded for its broad mandate, and the pharmaceutical industry had largely withdrawn from tropical infectious disease research. The existing R&D system could not meet the vast health needs of low-income countries. The research enterprise had simultaneously succeeded and failed.

Delivery

In 1955, based on the wartime success of DDT, WHO initiated an ambitious attempt to eradicate malaria by eliminating the vector. However, by 1969 the Global Malaria Eradication Programme (in fact it was never global, excluding much of sub-Saharan Africa from the outset) was considered to have failed. The program had nevertheless achieved considerable success in 25 countries in Africa, Asia, Europe, North America, and the Caribbean, primarily relatively rich and island countries and a few poor countries with good health infrastructure and seasonal malaria [21]. There were many reasons to give up the effort, including donor funding fatigue, local resistance to the imposition of control measures, insecticide resistance, and the difficulty of mosquito eradication in many ecosystems. Efforts reverted to control [22], and with the momentum for primary health care and the 1978 Alma Ata declaration calling for "Health for All" by the year 2000, malaria control was incorporated into primary care programs.

With the loss of visibility, combined with waning global interest and dwindling funding for research and control, malaria was soon overshadowed by the emerging HIV/AIDS epidemic in the 1980s. Between 1975 and 1994, malaria control was financed mostly as bilateral assistance to endemic countries, with yearly contributions of less than \$20 million, for an estimated \$364 million over 20 years. The impact of the "Silent Spring" movement and the near total cessation of DDT production [23], accompanied by rapid spread of resistance to the nearly ideal

antimalarial chloroquine, contributed to the resurgence of malaria, including in places where it had formerly been controlled. Malaria research and control had itself become a neglected initiative.

Phase III. 1990s to the Present: Global Health and Malaria Research and Control

Many factors have led to the consideration of health as a global imperative over the past two decades, particularly the disparate burden of HIV in poor nations and the AIDS activist movement, which revived a human rights approach to health care. With these changes in the value system and increasing attention to the concept of global public goods, malaria R&D and delivery have become priorities again.

R&D

In 1990, the independent Commission on Health Research for Development argued in its seminal report, *Health Research—Essential Link to Equity in Development*, that research had long been "under-recognized and neglected" as a tool to mitigate growing global inequities in public health [24]. With increasing globalization of trade, travel, information, and disease, health in general and R&D in particular were increasingly framed as "global" rather than "international," concerned with "the health needs of the people of the whole planet above the concerns of particular nations" [25]. This change also underscored "the growing importance of actors beyond governmental or intergovernmental organizations" [24]. The report of the WHO Ad Hoc Committee on Health Research Relating to Future Intervention Options set priorities for global health research and recommended an approach to allocate research funding [26]. Because confidence in the leadership at WHO among key global players was at an all-time low, an independent organization, the Global Forum for Health Research, was established in Geneva to catalyze and monitor investments in research relevant to the world's poorest people [27].

Malaria was a good example of a neglected disease in 1990, as both public and private actors had largely retreated from malaria research, even though drug-resistant malaria was spreading across the globe. In 1996, Harold Varmus, then Director of the US National Institutes of Health (NIH), concluded that malaria R&D merited increased funding because of its global impact and the potential for

scientific progress with increased funding. The same year, the UK-based Wellcome Trust reported on the domination of malaria research by scientists from the North [2]. In part because WHO was not deemed to have sufficient scientific depth or resources to address these disparities, the Multilateral Initiative on Malaria (MIM) was established in 1998 as a joint effort of northern country health research and bilateral aid agencies [28]. MIM rapidly improved channels for information flow between researchers in the North and South through data sharing and internet-based library access; established a repository for patient-, parasite-, and vector-derived chemical entities and genomes for research; provided research funds for African scientists through TDR; and initiated a regular Pan African Malaria conference to bridge the malaria research and control communities. The MIM Secretariat, based successively at the Wellcome Trust, the Fogarty International Center at NIH, and the Karolinska Institute, moved to its first African home in Tanzania in 2006, although securing long-term financial support remains a vexing problem. Enlightened leadership and commitment from the elite science funding agencies was the essential catalyst behind these changes.

By the late 1990s, the increasing self-confidence of senior African scientific leaders and maturation of young African malaria researchers into senior leaders, and recognition of their contributions to knowledge generation, placed them at the center of research planning and progress in malaria. Trainees in basic sciences, entomology, epidemiology, biostatistics and bioinformatics, sociology, behavioral sciences, and public health now could play key roles and become deeply involved in institutional leadership and management. The creation of MIM also pushed forward the visibility of malaria as a global problem, engaged leading research funding institutions in the North, and supported a global research network to link research to control. These actions laid the immediate groundwork for the launch of public-private-product development partnerships (PDPs) for malaria.

With the support of major foundations, PDPs emerged in the 1990s to address a glaring failure of existing institutional arrangements for R&D—that market-incentives had proven insufficient to drive investment in new tools for neglected diseases [29]. PDPs have redefined roles and expectations, with the public sector playing a stewardship and funding role, the private sector contributing materials

and know-how, and private philanthropy investing a significant share of the funds. New PDPs doing malaria research have been created, including Medicines for Malaria Venture (MMV), Malaria Vaccine Initiative (MVI), Drugs for Neglected Diseases Initiative (DNDi), and the Institute for OneWorld Health (iOWH). Thus far, two new fixed-dose combination malaria treatments based on artemisinin derivatives (DNDi) [30], a lower-cost synthetic method to produce artemisinin (iOWH) [31], and a licensed pediatric formulation of an artemisinin combination drug and a pipeline of new compounds in development to address emerging drug resistance (MMV) [32] have resulted. Though relatively new, PDPs have reinvigorated product development for malaria and other neglected diseases [33]. Furthermore, by placing affordability and accessibility at the center of their missions, they promote the concept of health R&D as a global public good [34]. Importantly, PDPs are explicitly expected to develop products well-adapted for use in low-income countries [35]. Nevertheless, the PDPs are relatively young, and it remains to be seen if they can efficiently deliver on their early promise over the long haul.

Local initiatives are now apparent as well. The African Malaria Network Trust [36] and the Malaria Clinical Trials Alliance [37] are African-led initiatives to strengthen malaria-related R&D capacities in Africa. They collaborate with northern partners and malaria PDPs to support African research institutions to develop products up through Phase III clinical trials. This reflects the recognition of African malaria scientists with the skills to conduct basic and clinical research and compete for funding, and reinforces the new norm that neglected disease research should involve endemic-country scientists and be targeted to meet low-income country needs.

Delivery

In 1992, the WHO Ministerial Conference on Malaria in Amsterdam [38] outlined a broad set of measures to reduce the burden of malaria, including early diagnosis and treatment, selective and sustainable preventive measures, early identification of epidemics and rapid responses to contain them, and strengthening of local capacities in basic and applied research. Much of this agenda was supported by northern research agencies, not WHO. To reestablish a central role for WHO, the newly elected Director General, Gro Bruntland, in 1998 established the Roll Back Malaria (RBM)

Partnership as a “Cabinet Project” reporting directly to her [39]. It signaled a new order of business at WHO—a global program partnership—responding to the widely held belief that malaria could not be controlled by governments and WHO alone but needed multiple public and private partners to succeed. The World Bank, UNICEF, DFID, USAID, foundations, NGOs, and the private sector quickly joined RBM, together with national governments and their malaria control agencies.

RBM’s mandate was to seek greater funding, raise awareness of malaria as a global problem, harmonize activities of the partners and support development of effective national programs. However, heavy-handed management by the Secretariat at WHO led to dissatisfaction with progress among the partners and with the manner in which they were being engaged. An external evaluation, required by the partners, damned with faint praise the accomplishments of the first four years, noting that advocacy was not supported by data, decision-making was inefficient, accountability within the Partnership was lacking, reductions in the malaria burden had been “slower than anticipated,” countries “receive inadequate and sometimes inconsistent technical advice,” and insufficient attention was given to “multi-sectoral approaches, particularly as regards private sector activity” [40]. Since then, RBM’s performance has improved. RBM’s recently issued Global Malaria Action Plan outlining strategies, costs, goals, and timelines is a major accomplishment, with multiple partner inputs. RBM is commissioning an independent evaluation to appraise the “governance; management; ability to convene, coordinate and harmonize RBM partners and stakeholders; and its impact on malaria efforts at country level” [41].

The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) was founded in 2002 as a new international financing mechanism for these three diseases and to harness the capacities of public, private, and civil society actors at both global and national levels [42]. GFATM was based on the premise that success depended on the involvement of multiple state and non-state actors. It was explicitly created as a public–private entity outside of and independent of the UN system. Furthermore, the concentration of funds from multiple public and private sources in GFATM (which totaled \$1.6 billion for malaria control between 2002 and 2007) was intended to decrease prior fragmentation of funding schemes. Despite

increasing multilateralism from many global health actors, the US has been a reluctant partner in GFATM since its founding, preferring to invest most of its significantly increased commitment through bilateral programs, such as the President’s Emergency Fund for AIDS Relief (PEPFAR) and the President’s Malaria Initiative (PMI). Total US pledges to GFATM from its inception through January 2009 amount to \$4 billion. The Obama administration’s budget request for 2010 includes a 36% increase in malaria support, a 2.5% increase for PEPFAR, but no change in funding for GFATM, thus continuing the major emphasis on bilateral program support.

Phase IV. The Future: Lessons Learned and Global Public Goods for Global Health

The past 30 years has witnessed significant shifts in the types of actors and the roles they play in malaria research and control, with gradually increasing integration of the R&D&D communities. With these changes, a number of new modes of operation have been established that seem certain to continue, such as: (1) a more central role for endemic-country researchers in an increasingly globalized research system; (2) direct funding to local researchers and institutions; (3) the involvement of affected communities not only as targets of interventions but as co-producers of results; (4) new actors taking on tasks formerly vested in WHO; and (5) new PDPs to drive research to unmet needs and new product development. These developments bode well for achieving the prospects for new, effective, adapted, and affordable tools for malaria

A new challenge to the global health system is the recent decision by the Bill and Melinda Gates Foundation, in addition to its support of malaria PDPs, to place malaria eradication back on center stage [43]. Not all experts agree that malaria eradication is feasible or desirable [44]. Regardless of the validity of the criticism, it is necessary to continue to develop and apply new tools to eliminate malaria as a significant public health problem, as disease reduction is the necessary antecedent to any attempt at eradication of the parasite.

New mechanisms for partnerships among global and national organizations have pioneered new approaches to financing and governance of programs, such as GFATM and RBM, along with major bilateral investments, such as PEPFAR and PMI. In addition, the interests of the

science community now connect to product development to tackle growing drug and insecticide resistance. These innovations have focused on neglected infectious diseases that by definition affect *only* developing countries. Such innovations leave the question unanswered of who contributes to and who benefits from R&D for diseases that affect *all* countries, such as noncommunicable diseases, including cancer, cardiovascular disease and stroke, diabetes, and obesity [45–50]. The challenge of building effective new R&D&D arrangements in the twenty-first century for all health needs of all people should be informed by past developments in malaria. The most relevant developments to draw upon are the challenges of filling the institutional gaps within the global health system to link R&D with delivery; of effectively connecting local and international researchers; and finally of ensuring support for the generation of global public goods for global health. A step in that direction has recently been taken by the leading national research agencies of a number of developed and developing nations. These have come together to form the Global Alliance for Chronic Diseases [50], with a pledge to invest in research in a coordinated manner, and to scale up promising interventions to achieve targeted goals of disease reduction.

Conclusions

In this paper, we have reviewed the century-long effort to research malaria, to

develop tools for control, and to implement them. It is clear from our review that support for and inclusion of local research institutions in global health research is essential to develop well-adapted health tools and to strengthen collaborations between global and local actors in implementation. Such support and inclusion is a necessary precursor to the emergence of stronger and more integrated global research, development, and delivery, which we have termed the R&D&D system. The role of WHO in this global system must evolve as a partnership with other actors.

Building an effective global health system takes times. It required decades to build up research capacity in malaria-endemic countries to the present level, when local researchers can play an integral role in malaria R&D&D. Investments in capacity building in other relatively neglected areas, such as noncommunicable diseases, must begin today if we expect similar dividends in the future.

R&D must connect closely to the challenges of implementation. The historical divide between academic research, industry development, and those who implement in the real world cannot continue if “acting in time,” translating knowledge into action, is a critical goal. Those in the R&D world must understand what the control community has to deal with, and the latter need to know what is in the R&D pipeline in order to identify the delivery constraints that must be solved.

Enlightened leadership within organizations comes with a commitment to scaling up the level of R&D and capacity-building investments, harnessing the potential gained from connecting researchers in the North and the South, and articulating the messages to decision makers and the general public to gain support. The new Global Alliance for Chronic Disease appears to have heard the message, as these issues are highlighted in its mandate.

Finally, the case study of malaria suggests that a multiplicity of partnership models is useful, particularly for diseases that require multiple interventions and continuing R&D. The global health system of the future must identify ways to include those who suffer from diseases, those who contribute to R&D, and those who deliver interventions, sharing the responsibility to link better knowledge with action for those in need.

Author Contributions

ICMJE criteria for authorship read and met: GTK WLK SM NAS CMM. Wrote the first draft of the paper: GTK. Contributed to the writing of the paper: GTK WLK SM NAS CMM. Co-planned and organized the work on which this and the other papers in the global health system series are based: GTK. An original conceptualizer of the study, and co-PI on the grant supporting it: NAS. Involved in conceptualization and initial drafting of this paper, and provided input throughout the writing process: NAS.

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The Global Health System: Lessons for a Stronger Institutional Framework

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This is the fourth in a series of four articles that highlight the changing nature of global health institutions.

Introduction

The global health system is in a period of rapid transition, with an upsurge of funds and greater political recognition, a broader range of health challenges, many new actors, and the rules, norms and expectations that govern them in flux. The introductory article of this series (Szlezák et al. [1]) laid out some of the many challenges facing the global health system. This system is defined as the constellation of actors (individuals and/or organizations) “whose primary purpose is to promote, restore or maintain health [2]” and “the persistent and connected sets of rules (formal or informal), that prescribe behavioral roles, constrain activity, and shape expectation [3]” among these actors. The second article (Frenk [4]) defined the key attributes of national health systems as a core component of the global system. The third article (Keusch et al. [5]) analyzed the institutional evolution of one of the system’s most important functions—the integration of research, development, and delivery.

This concluding article draws on the others in the series. It also draws from a year-long effort that included case studies, two international workshops of scholars and practitioners (further details at <http://www.hks.harvard.edu/centers/cid/programs/sustsci/events/workshops/2008/institutions>), and ongoing discussions by the authors, to summarize lessons learned and propose future actions to strengthen the system as a whole. The project used as a case study the global health system’s evolving response to

malaria. Nevertheless, the workshops and discussions that informed this analysis drew from a broader range of cases, and we believe lessons learned may usefully apply beyond malaria alone. Furthermore, while recognizing the many determinants of health and interlinkages between health and other issue areas such as trade and environment [6,7], we limit our scrutiny here to the global health system.

The project concluded that an effective global health system must accomplish at least five core functions: agenda-setting; financing and resource allocation; research and development (R&D); implementation and delivery; and monitoring, evaluation, and learning. We discuss here ways to improve each of the five functional areas, consider the implications for the role of the World Health Organization (WHO), and make recommendations for future action.

Key Functions of the Global Health System

Agenda-Setting

In the past, global agenda-setting in health took place within the framework of the United Nations (UN)—primarily at

WHO and the UN Childrens Fund (UNICEF)—with input from national governments and a few foundations. It was exemplified by iconic programs such as the eradication initiatives for malaria and smallpox in the 1950s–70s. Agenda-setting is well captured by a “punctuated equilibrium” model, in which long periods of relative stability in agendas are sporadically broken by sudden bursts of high-level attention in public and policy circles [8,9]. Agendas may vary because of crises, such as natural disasters or epidemics, or from recognition of the human and economic costs of inaction, as with noncommunicable diseases [10]. History indicates that these episodes of high attention are fleeting; seizing these brief opportunities to produce lasting change usually requires adapting governance structures to accommodate new actors and interests [11].

Our case study of malaria found that, after undergoing a half-century of fluctuating global attention, malaria re-emerged on the global agenda in the late 1990s. Central to its reemergence was the creation of a novel global governance structure, the Roll Back Malaria (RBM) Partnership, launched by WHO. RBM

Citation: Moon S, Szlezák NA, Michaud CM, Jamison DT, Keusch GT, et al. (2010) The Global Health System: Lessons for a Stronger Institutional Framework. *PLoS Med* 7(1): e1000193. doi:10.1371/journal.pmed.1000193

Academic Editor: Gill Walt, London School of Hygiene and Tropical Medicine, United Kingdom

Published: January 26, 2010

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Funding: This work was supported by a grant to the Institutional Innovations in Global Health project by the John F. Kennedy School of Government at Harvard University, Cambridge, Massachusetts (US) under its “Acting in Time” program. Additional support was received from the Burroughs Wellcome Fund, Research Triangle Park, North Carolina (US). The funders had no role in the decision to publish or preparation of the manuscript.

Competing Interests: Suerie Moon has been a consultant for UNITAID and WHO.

Abbreviations: ACT, artemisinin combination therapy; GFATM, Global Fund to Fight AIDS, Tuberculosis and Malaria; INCLIN, International Clinical Epidemiology Network; M&E, monitoring and evaluation; PDP, public-private product development partnership; R&D, research and development, RBM, Roll Back Malaria; TDR, Special Programme for Research and Training in Tropical Diseases; UN, United Nations; UNICEF, United Nations Children’s Fund; WHA, World Health Assembly; WHO, World Health Organization.

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Provenance: Commissioned, externally peer reviewed.

The Policy Forum allows health policy makers around the world to discuss challenges and opportunities for improving health care in their societies.

now includes over 100 organizations including endemic country governments, donors, civil society organizations, the private sector, and academia.

Once an issue garners attention and attracts many new actors and activities, effective governance requires a process for setting an agenda for action *within* the issue area. Coordination is ultimately essential; however, as several experienced participants in our workshops pointed out, few organizations wish to be coordinated, because of the costs and loss of autonomy entailed. Thus coordination and some degree of harmonization of multiple independent activities are likely to emerge only after the construction of consensus on a widely shared set of rules, roles, and expectations. To get to this consensus, participants must share a clear set of goals and perceive the process as inclusive, transparent, technically credible, and fair.

Effective agenda-setting for action, when achieved, can provide a framework (albeit no guarantee) for coordination at global and national levels. The 2008 Global Malaria Action Plan, which was negotiated within the RBM framework, exemplifies how global agenda-setting for action within an issue area can be achieved [12]. A similar institution, the Stop TB Partnership, has also created a coordinating framework for tuberculosis control.

Underlying such institutional frameworks must be scientifically valid metrics, evidence of the problem's importance, and recognition that tools exist, however imperfect, that could improve health outcomes. Finally, the framework requires that the affected countries and the public, who are ultimately co-producers of health, be represented as key participants [4]. These partnerships, anchored by the legitimacy of the WHO, represent creative approaches to eliciting the broad participation necessary to construct widely accepted agendas and forge consensus at the global level.

Financing and Resource Allocation

International financing and resource allocation for health in developing countries have long been subject to three fundamental questions [13]: (1) How should the priorities of donors be balanced with those of recipients? (2) How should resources be allocated to different diseases or issue areas? (3) How can sufficient investment into health, which has traditionally been underfunded relative to need, be ensured?

In the past, international resources for health flowed primarily through bi-/mul-

tilateral donors and WHO with only a few exceptions, e.g., the Rockefeller Foundation. Over the past decade a variety of actors, including philanthropists, advocacy groups, civil society, and public and private sector organizations, have catalyzed an unprecedented increase in the flow of international financing for health [14]. In the case of malaria, funding has increased tenfold [12]. The Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) represents a model for enabling some coherence in the resource allocation process for its mandated diseases. The GFATM balances two often-competing objectives: providing reassurance to donors by only funding projects adhering to international "best practices," and demanding that country applications demonstrate meaningful and widespread national ownership [15]. By unifying multiple funding streams and oversight processes, the GFATM also tries to lighten the burden put on national health systems by reporting requirements and lack of coordination among multiple donors—an issue exacerbated by the recent increase in players in the global health system.

While the upsurge of financing for malaria is welcome, it also points to a current governance gap in the overall system: there are no clear norms for how resources should be allocated across different health needs. The Global Burden of Disease and Disease Control Priorities Projects have provided country estimates of years of healthy life lost to illness and injury, identified major risks, and estimated the cost-effectiveness of interventions [16,17]. However, widely accepted principles on how to translate these figures into resource allocation decisions are lacking. Major discrepancies exist between resources provided for specific diseases and their relative burden, e.g., HIV/AIDS versus chronic diseases, and between the burdens of disease within specific countries and their ability to attract resources to address them [18].

A related question is how to increase funding levels further to meet the full spectrum of global health needs, and how to sustain those levels in the long run. Especially in difficult economic times, it is critical to ensure continuity by insulating finance arrangements to the greatest extent possible [19]. In all World Bank regions, external development assistance represents less than 3% of total health spending, with the exception of sub-Saharan Africa where it accounts for 21% [20]. However, international financing is critical for providing global public goods and for the lowest-income countries

that rely on aid to meet basic health needs. Financial fluctuations can be disruptive in all countries, but for the poorest, a sudden drop in aid can be devastating. The long-term sustainability of financing will rest on three elements: (1) demonstrating results; (2) making financing arrangements more politically acceptable by mobilizing more resources from middle-income countries; and (3) developing innovative financing mechanisms that are less vulnerable to politicized budgeting processes. One such innovative model is UNITAID, which purchases health products for use primarily in low-income countries and is funded through national airline taxes. Of the 29 committed UNITAID donors, three-quarters are low- or middle-income countries, emphasizing the idea that all nations—even the poorest—can contribute to sustainable global health finance [21].

Research and Development

In the past, health technologies such as drugs, vaccines, and diagnostics were developed primarily by and for populations in the industrialized world. Today there is increasing evidence of contributions from the South to global health research. Investments in human capacity that began in the 1970s are now bearing fruit as scientists from Africa, Asia, and Latin America take a key role in advancing research, as in the case of malaria [5]. After a period of neglect, there is now a resurgence of R&D aimed specifically at developing new tools for the health needs of developing countries. Since traditional market incentives such as the patent system are unlikely to generate the necessary innovation, much of malaria R&D is now taking place through public-private product development partnerships (PDPs), which receive significant philanthropic, public, and private investments [22]. In contrast to classic private-sector product development, however, the PDPs have an explicit objective of jointly achieving affordability and innovation suited to developing country contexts. PDPs are redefining the roles of public and private sectors and promoting new expectations for the development of health technologies as global public goods.

Experience with malaria offers several lessons for R&D in other health areas. First, investments in human capital are essential but take many years to bear fruit. Here the long-term commitment of the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR) and the recent £30 million commitment from the Wellcome Trust for research capacity

building in Africa should be noted [23]. Nevertheless, greater training in laboratory sciences, health economics, management, program evaluation, and implementation research are clearly needed. Capacity-building of developing country researchers and research organizations (e.g., universities, public research institutes) should receive greater emphasis and be scaled up today. Second, considerations of access to products should be built into R&D processes from their inception. The WHO Global Strategy and Plan of Action on Public Health, Innovation and Intellectual Property, approved at the 2008 World Health Assembly (WHA), is an important contribution to rethinking the governance of the R&D system, and merits the constructive engagement of all concerned parties [24].

Implementation and Delivery

As the essential link between global actors and local populations, national health systems are a critical part of the global health system. Health systems must accomplish multiple challenging tasks. These include: providing preventive and primary care services; developing a health workforce; devising equitable financing arrangements; regulating the private sector; and leveraging vertical programs (such as malaria control) to strengthen, rather than distort, the overall health system (“diagonalization” [25]) [4].

Health system performance varies widely but the reasons for this variation remain poorly understood. For example, Eritrea, Ethiopia and Rwanda have reduced malaria-related morbidity and mortality dramatically [26,27]. Eritrea, for one, credits the RBM strategy and community health workers as key components of their approach [28]. However, it is unclear why, largely using the same strategies recommended to all endemic countries, others were less successful. Recent analyses of health systems performance point to leadership, community involvement, district-level focus, use of data to set priorities and track progress, and prioritizing equitable access as key factors that have enabled significant improvements in health outcomes in some countries [4,29]. Even when public sector delivery capacity is weak, some countries have still managed to expand primary health care coverage and improve childhood survival by engaging the private for-profit as well as nonprofit sectors [29]. These non-state actors can energize national health systems by sharing knowledge of how better to achieve efficiency, outreach, and user satisfaction. A comprehensive operational

and policy research agenda is needed to understand fully which policies and practices best strengthen national health systems [30,31].

Monitoring, Evaluation, and Learning

Reliable information on the impact of health programs is critical to setting priorities, measuring efficacy, and maintaining global support for any intervention. Yet the global health system currently poorly manages monitoring and evaluation (M&E). There is no consensus on key questions regarding who should be responsible for M&E, how it should be carried out, how available the information should be, and how it should be used. National and subnational organizations for conducting M&E and promoting critical learning are relatively weak, and incentives for strengthening them are almost nonexistent.

For example, there remain enormous gaps in knowledge about malaria. Precise annual and seasonal malaria incidence and mortality data, or the percentage of children with fevers that actually have malaria, are unavailable in most endemic countries and districts [28,32–34]. How to mobilize communities to make full use of bed nets, artemisinin combination therapies (ACTs), and indoor spraying remain critical research issues. With increasing funds being expended on programs, it is shortsighted that so little is spent on operational research, on learning what works in specific contexts and how best to engage communities to use the tools available [35]. An essential step toward sufficient investment in M&E is to acknowledge and plan for its costs, both in dollars and, more importantly, in the limited time available from experienced managers and researchers. This research is vital, yet ironically it is too rarely funded by major donors nor requested by implementing countries.

M&E should be an integral part of all program planning, yet it is too often an afterthought. Furthermore, effective M&E of programs and interventions, as well as learning from experience, requires that M&E efforts achieve technical *credibility*, maintain *legitimacy* (i.e., general acceptance of their authority), and produce knowledge that is *salient* for end-users. These three objectives often compete directly with one another [36]. For example, there is often tension between the goal of producing data for internal learning and that of monitoring by outside parties (e.g., higher-level officials or donors). When evaluation data are linked to funding, as in currently

avored “performance-based funding,” the accuracy of the data provided may diminish. It may be necessary to create institutional “safe spaces” where failures can be divulged to encourage genuine learning rather than used to assign blame for underperformance [37,38].

Similarly, at the global level, all countries provide health statistics to WHO, but the quality and validity of these data vary greatly. Yet WHO is a producer, repository, and evaluator of evidence, and simultaneously a political organization representing 193 countries, and so it will be particularly difficult for the organization to meet the demands for saliency, credibility, and legitimacy. Academic researchers, who also play a critical role in M&E, face a contrasting set of difficulties. While they may achieve technical credibility, it is more challenging to achieve political legitimacy and ensure that the knowledge produced is salient to end users and policy-makers.

Several new organizations are addressing some of these issues. For example, the Institute for Health Metrics and Evaluation [39] and the WHO-hosted Health Metrics Network [40], both funded in part by the Bill & Melinda Gates Foundation, were recently created to develop methods to acquire, analyze and disseminate relevant and reliable information on burden of disease and global health. There are promising models, some country-based such as the India Program Evaluation Network coming out of the International Clinical Epidemiology Network (IN-CLEN) [41] and the India network, IndiaCLEN [42], others international, such as the Southern-led INDEPTH epidemiological network [43] and the Cochrane Collaboration [44]. The challenge is not only to secure the evidence, but also to have the political and procedural legitimacy that, to date, few organizations other than the UN agencies have been chartered to provide.

The Role of WHO

Cutting across these five core functions is the question of how changes in the global health system redefine the role of WHO. WHO is facing “an urgent need to define and assert a clear and effective role for itself, as never before” [45]. There are at least three key roles that we believe only WHO can fulfill and therefore must do well. The first is global stewardship, i.e. identifying needs to be met and taking a leadership role in setting global norms. Second is as a provider of operational support to countries: WHO has a unique

capacity to engage the best experts worldwide, which should enable it to provide technical assistance to governments through normative guidelines and recommendations reflecting best evidence and practice. To retain the legitimacy to do so, it must maintain the highest technical and ethical standards [46]. The third is its special role in governance: as the major global *intergovernmental* health organization, WHO has a unique convening power and mandate for decision-making on major health-related issues. Its governing body, the World Health Assembly, with its 193 Ministers of Health, provides WHO its singular legitimacy to carry out these mandated roles of stewardship, country support, and governance, albeit with a high degree of bureaucratization and politicization. Yet WHO's regular budget resources are remarkably limited. For the 2006–7 biennium, the formal budget assessed on countries was less than \$1 billion (with voluntary contributions the total budget was just over \$3 billion); the following period, three-fourths of the budget was allocated to the regions [47]. This excessive budgetary decentralization undermines WHO's capacity to deliver the global public goods demanded of it.

Inadequate levels of core funding have resulted in predictable consequences for performance. For example, WHO's malaria program has experienced a number of difficulties in recent years, and while inadequate funding is not the only cause it is an important one. When WHO fails to lead, new global partnerships such as RBM (originally created by WHO's Director-General) have stepped in, received external funding, and, to an extent, WHO has been marginalized. For WHO to fulfill the key roles for which it is uniquely charged, it will need strong leadership, strengthened technical expertise, and clearer focus. The current economic crisis provides an opportunity for WHO to redefine and strengthen its core functions, recognize what it cannot do well, and delegate to or partner with other organizations. If it can define its core functions and strategic role credibly, the organization will justify—and perhaps be more likely to receive—the greater resources it will need to fulfill its central global mission.

Lessons and Future Needs

Several general lessons have emerged from our study of institutions in the global health system.

- In the present complex global environment no single actor can or should

set the agenda for action. Global partnerships similar to those that have transformed malaria and the infectious disease agenda will be needed to mobilize resources for other health problems, such as chronic diseases. An example is the new Global Alliance on Chronic Diseases [48]. Broad-based, participatory processes for agenda setting, anchored by WHO's global political legitimacy, will be required to define priorities, avoid unnecessary duplication, and share knowledge. There is clearly a tension between WHO as an *intergovernmental* organization and WHO as a partner in multiple partnerships where it must share power with a broader set of *nongovernmental* actors including civil society organizations, foundations, and the private sector. Widely accepted procedural principles including transparency, broad participation, integrity of data, and equity should be adopted to construct the consensus necessary for effective coordination.

- Sustainability depends on strengthening national health systems, which are the essential link between global knowledge and best practices, and local health needs and impact. Disease-specific international funding also has much to contribute. But it can distort national priorities, pull resources from less-popular programs, and ultimately undermine the overall performance of the health system [49]. Country experts are often in a better position to set priorities than outside consultants. Donors should allow greater flexibility for recipient countries to direct a portion of received funds beyond narrow programmatic interventions to strengthening national health systems. This will require the development of clearly defined goals and performance indicators for key functions of health systems such as service provision, research, health worker development, and equity of access.
- Ironically, the proliferation of global actors threatens to weaken health systems by placing additional reporting burdens on already thinly stretched health ministries [49]. By channeling multiple funding streams into a single source for HIV/AIDS, tuberculosis, and malaria, the GFATM offers an instructive example of how to distribute the resources of various donors in a way that is sensitive to national health systems' priorities and constraints. As new global health initiatives arise to

address the wave of emerging health challenges, the global health system should identify and adopt analogous ways to streamline reporting and, more generally, to minimize the additional transaction costs put on countries.

- Systematic investment in creating new and improving existing M&E programs should become second nature for all global health activities. The global health system has two important functions to fulfill. First, it needs to set the tone and actively foster the idea that M&E is crucial to global health. Second, it needs to support the systematic exchange, coordination, and streamlining of M&E efforts. Over time, this investment will contribute to building robust M&E systems and to generating reliable, comparable data to inform action.
- There is compelling evidence that long-term investments in education and training at many levels (e.g., national, provincial, district) can result in large payoffs for improved health [5,50]. The global health system should prioritize additional investments in longer-term, multidisciplinary education and training for leadership in the complex public health, medical, management, economic, education, communications, and policy aspects of health systems, and in the functioning of health systems overall.
- Finally, it will be critical to support research that provides the evidence and knowledge bases for prioritization, resource allocation, and the development and evaluation of new tools and interventions. In particular, operational research will be crucial to learning how to use the tools that are available, take them to scale, and engage populations to become co-producers of health rather than passive recipients of services. More broadly, research should be promoted to understand variation in the performance of different national health systems, and thus to identify system designs that can be adapted to local circumstances to help translate global aspirations into meaningful impact on people's lives.

Author Contributions

ICMJE criteria for authorship read and met: SM NAS CMM DTJ GTK WCC BRB. Wrote the first draft of the paper: SM NAS. Contributed to the writing of the paper: SM NAS CMM DTJ GTK WCC BRB. One of the two

original conceptualizers of the study, and PI on the grant that supported it: WCC. Chaired the

steering group for the project and supervised the research and workshop planning: WCC. In-

involved in the conception of the project and organization of the meetings: BRB.

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