Toward Control of Infectious Disease: Ethical Challenges for a Global Effort

Margaret P. Battin, Charles B. Smith, Leslie P. Francis, and Jay A. Jacobson

Abstract Despite the devastating pandemic of HIV/AIDS that erupted in the early 1980s, despite the failure to eradicate polio and the emergence of resistant forms of tuberculosis that came into focus in the 1990s, and despite newly emerging diseases like Severe Acute Respiratory Syndrome (SARS) in 2003 and the fearsome prospect of human-to-human avian flu, it is nevertheless a time of some excitement over prospects for effective control of much of infectious disease. Funded by national and international governmental and nongovernmental organizations (NGOs), private foundations, and even popular entertainers, large-scale new efforts are under way to address global killers like AIDS, tuberculosis, and malaria, among others. This "marvelous momentum" can be seen as part of a continuing effort from the time of Jenner onward. Extrapolating from this, we explore the notion of a "*comprehensive global effort for the eradication, elimination or control of infectious disease*," with particular attention to the ethical issues that arise. This is to "think big" about disease-control efforts that are now often done in piecemeal ways. This chapter identifies five tracks along which such efforts need to be pursued: (1) national and international organizations and the development of collective will; (2) epidemiological and health care infrastructure; (3) scientific development; (4) religious, social, and cultural considerations; (5) legal and social protections for individuals and groups. Each of these poses significant ethical issues which, we argue, should be viewed in a comprehensive way, to ensure that practice, research, and policy in each of these areas understands the person with communicable infectious disease as both victim and (potential) vector.

Keywords Bioethics, infectious disease, communicability, victim, vector, AIDS, tuberculosis, malaria, global health, developing world

Introduction

Despite the devastating pandemic of HIV/AIDS that erupted in the early 1980s, despite the failure to eradicate polio and the emergence of resistant forms of tuberculosis that came into focus in the 1990s, and despite newly emerging diseases like

SARS in 2003 and the fearsome prospect of human-to-human avian flu, it is nevertheless a time of some excitement over prospects for effective control of much of infectious disease. Funded by national and international governmental and nongovernmental organizations, private foundations, and even popular entertainers, large-scale new efforts are under way to address global killers like AIDS, tuberculosis, and malaria, among others. Legal standoffs over patent rights to antiretrovirals and other drugs have to some extent been resolved, and pressure is being exerted for the improvement of infrastructure issues, like clean water and improved sanitation. Research in the identification of pathogens, as well as in the prevention, diagnosis, and treatment of infectious diseases, has made very great progress in some areas, especially in vaccine development and the development of rapid tests, in pandemic forecasting, and in the establishment of globally coordinated disease outbreak surveillance networks. At last, attention is being focused on orphan infectious diseases and the so-called neglected tropical diseases. It is, we think, a moment of growing optimism. Finally, after what has seemed like a long hiatus—roughly since the late 1960s and early 1970s when the then surgeon general was apparently saying that it was time to "close the book on infectious disease," and concern over infectious disease was slipping out of public view, at least in the developed world—broad and publicly visible efforts at control are now again being made as a central part of the new concern for global health. Progress, it seems, is in the air.

A "Marvelous Momentum" for the Control of Infectious Disease

It is important to understand how very recent the new optimism is—as we write this, it is only about seven or eight years old. In 1999, the Gates Foundation announced that it would contribute $25 million to the International AIDS Vaccine Initiative (IAVI) to further the development of an AIDS vaccine, and the following year dedicated $90 million towards control of HIV/AIDS in Africa, especially to decrease the rates of new infections and maternal–child transmission, and provide resources and training in palliative care to children orphaned by AIDS (Bill & Melinda Gates Foundation 2008). The impressive size of the Gates' contributions, together with the fact that they came from a private entity rather than a governmental organization, contributed to a new optimism that at last something could be done to try to bring under control one of the world's most devastating pandemics, one that echoes the plagues of the middle ages and the 1918 influenza.

In the perception of both the public and of many professionals, this infusion of money and energy served as the turning point (Cohen 2006, 162–167) after years in which many institutions and governments, including that of the United States, had done little or nothing to try to stop the AIDS pandemic as a global phenomenon—even after effective drugs had been developed. The wealthy nations, especially the United States, had been attentive to issues of HIV treatment in their own populations and patent protections for their own pharmaceutical industries, but were seemingly oblivious to the skyrocketing death rate in the developing world and the

devastation of an entire continent. HIV control on a global scale seemed impossible. However, galvanized perhaps by the infusion of both optimism and cash from the Gates Foundation, within the past decade governments, NGOs, public/private partnerships, multinational corporations, religious groups, and entertainers have rushed to contribute to a far more concerted effort to reduce the global burden of AIDS and with it other infectious diseases as well.

In fact, considerable progress toward the control of infectious disease had been being made during the decades of the 1970s and 1980s in the development of vaccines, anti-infectives, and methods for disease prevention and treatment. With the emergence of HIV/AIDS on a global scale, the public awakened as well. The World Health Organization (WHO) had been making tireless efforts over the years, culminating in the ambitious 3 by 5 program to have three million HIV patients receiving antiretroviral therapy by 2005. Other foundations as well as Gates had been concerned with global health, like the Rockefeller Foundation; so were many national and international governmental institutions. Evolving market forces and improved education also played some role. But the Gates Foundation's immense contribution of private funding to fight AIDS has served as a catalyst, giving focus to many other efforts, both those initiated beforehand and especially those introduced afterwards. Governments of affluent countries have become major donors to efforts to improve global health: the United States, France, Italy, the United Kingdom, Canada, Germany, the Netherlands, Sweden, Spain, Norway, Denmark, and Russia, ranked by size of contribution to the Global Fund as of early 2008, but less affluent countries have also been donors: Romania, Brazil, Mexico, Slovenia, Poland, and Hungary (The Global Fund, 2008). Funds have poured in from multiple sources—a total of some $35 billion, by one estimate, as of January 2006 (Cohen 2006, 162–167). Laurie Garrett, seconded by Paul Farmer, calls this "a marvelous momentum" (Garrett 2007) (Farmer and Garrett 2007) towards assistance in global health.

To be sure, this picture of progress and emerging comprehensive global efforts toward the improvement of global health, and with it the control of infectious disease, is hardly a fully coordinated or integrated one: efforts by one foundation or NGO sometimes reduplicate efforts by another, and related but not-quite-parallel research programs leave gaps where articulation of related efforts might be much closer. Competition between entities, international tensions, commercial agendas, and very different styles of research funding and priority-setting make the picture far from seamlessly smooth. Political agendas sometimes undercut research; research sometimes violates local custom or understandings of fairness; popular misunderstandings sometimes block immunization drives and other efforts to control the transmission of disease. Officials at one organization complain of dominance by another (McNeil 2008). There have been disappointments and failures: the 3 by 5 program for AIDS and Roll Back Malaria, for example, did not meet their ambitious initial goals. Only one million rather than three million people were receiving combination antiretroviral therapy for HIV/AIDS in developing countries by June 2005 (WHO/UNAIDS 2005). Roll Back Malaria's clear pledge in 1998 to cut deaths from malaria in half by 2010 was labeled a failure, its principal contributors admitting that it was "acting against a background of increasing malaria burden"—that is, that malaria deaths were going up, not down. (Yamey 2004, 1086–1087).

Furthermore, attention to infectious disease has been patchwork in character, focusing on some high-profile diseases while ignoring others that cost far more lives. While AIDS, Ebola, and avian flu fuel widespread fear, some ongoing endemic killers, such as infantile diarrhea and childhood acute respiratory tract infections, receive little press and correspondingly little funding or policy attention. Indeed, Solomon Benatar laments the "siloed" character of approaches to infectious disease (Benatar 2005), one disease at a time. Laurie Garrett despairs of "stove-pipe" funding: aid that is piped down narrow channels relating to a particular pro-gram or disease, ignoring broader needs and concerns: she cites as an example the case in which a government receives considerable support for an antiretroviral distribution program for mothers and children in a specific area, but nothing else. The consequence: mothers who are HIV+ receive drugs for their own infection and to prevent maternal/infant transmission at delivery, but they cannot obtain obstetric and gynecological care or infant immunizations (Garrett 2007, 22–23). Attention to specific diseases has seemed to be quite unequal: while massive research efforts have been directed towards development of a vaccine against HIV, with more than 30 candidates currently in the pipeline, no new tuberculosis vaccine has been developed since 1921, even though the TB bacillus is a technically easier target than the human immunodeficiency virus. In most developing countries the method of diagnosing TB is still the same as that used in 1847.

Yet even if not fully coordinated and sometimes seeming to undercut each other, these disease-by-disease, program-by-program efforts all focus directly or indirectly on a common goal, the reduction of the global burden of infectious disease. Thus these varied efforts can all be seen as a sort of mosaic or kaleidoscope of specific efforts that perhaps all form part of a broader one, coming incrementally into being. The many programs of research in vaccines and antimicrobials, the various water purification and public sanitation projects, the various initiatives for the control of diseases from AIDS to human papillomavirus (HPV)-caused cervical cancer to river blindness, and the multiple legal and social programs like model statutes and pandemic prioritization policies contribute to these emerging, newly coalescing global efforts towards the ulti-mate goal of control of infectious disease, the details of which are being continuously filled in and modified as the various individual projects are developed and become more fully integrated. We can think of it as a projection forward of current efforts and an anticipation of future ones, an ongoing, overall project under continuous develop-ment. Call this still-emerging set of efforts by a unifying name: a *Comprehensive Global Effort for the Eradication, Elimination, or Control of Infectious Disease*.

A Vision for 2020–2030? A *Comprehensive Global Effort for the Control of Infectious Disease*

We want to take advantage of this forward-looking, unifying, optimistic picture of new progress and reenergized enthusiasm over the last seven or eight years to examine the ethical questions a genuinely global effort would raise. After all,

practical success as the various components of this overall effort move forward does not entail ethical success, either in their mosaic diversity or as a comprehensive whole.

One way to give the notion of an emerging *Comprehensive Global Effort* concreteness and urgency is to think about what would need to happen if we were to try to bring these various efforts to fruition within a given decade—for example, to imagine implementing it fully within, say, the decade 2020–2030. A clearly defined *Comprehensive Global Effort* imagined as just far enough away to give some time for coordination and preparation would nevertheless be close enough to make a real difference to the world today. This is a somewhat visionary approach, but not just fantasy—rather, it is an approach that looks ahead to a future we can reasonably foresee.

To the degree that such an approach involves extrapolating into the future from current trends, we can hardly be sure what the conditions and events even in the future will be, or whether a *Comprehensive Global Effort* could or will succeed or even partly succeed. It might work; it might not; or it might be only a partial success.

Elsewhere, we have described what we call the "patient-as-victim-and-vector view," or *PVV* for short, as a way to think about issues of policy and practice. It begins with an account of the patient—the person, indeed any person—as physically "embedded" in a web of disease, a "way-station self" who is breeding ground and launching pad for literally trillions of microorganisms, many of which are benign or crucial to human functioning but some of which are dangerous or lethal, and involves three intertwined perspectives through which to take account of the phenomenon of transmissibility of disease: self-views, population-level views, and hypothetical, Rawlsian-like views (Battin et al. 2008). The normative conclusion of the PVV view can be stated simply:

> *Ethical problems in infectious disease should be analyzed, and clinical practices, research agendas, and public policies developed that always take into account the possibility that a person with communicable infectious disease is both victim and vector at one and the same time.*

Using this view of the patient as both victim and vector, we can reasonably foresee something about the ethical challenges that can be expected to arise along the way as the *Comprehensive Global Effort* proceeds, and it is these challenges we wish to explore here.

A more pessimistic version of the same projection of a *Comprehensive Global Effort* despairs of the possibility of ever achieving control of infectious disease or doing so within a specific period of time. It asks instead what are the crucial features in delay—what factors are operating now or might operate in the future to make such a goal unattainable? Could the fearsome prospect of virtually total collapse of public health portrayed so effectively by Laurie Garrett in *Betrayal of Trust* (Garrett 2001) be inevitable? Could the effects of climate change and global warming destroy advances in environmental preventatives like vector control, or could the expansion of warfare and ethnic cleansing, especially that which employs deliberate tactics for spreading infectious disease, undercut any progress in disease-control programs? And what ethical failures in disease control are

becoming increasingly evident, and what ethical objections might be so strong that they would be sufficient to warrant blocking of any attempt to undertake comprehensive global efforts?

Leaving these concerns aside for the moment, the optimistic picture we explore here of an emerging *Comprehensive Global Effort for the Control of Infectious Disease* is in one sense an elaboration and expansion of a comparatively simple thought-experiment about airport surveillance for infectious disease, a way of considering what constraints would be acceptable in the effort to eradicate, eliminate, or control the serious human infectious diseases. This thought experiment considered the possibility that rapid testing (and treatment) were available for all the major infectious diseases—and asked whether it would be permissible to require such testing of everyone before they boarded an airplane. The inconvenience would be limited—just a cheek swab, a short delay (perhaps 20 minutes, perhaps as short as 120 seconds), and of course a longer delay with treatment if necessary—but the possibility of reducing the global burden of infectious disease would be immense (Battin et al. 2008, chapter 15). In another sense, it is a projection of the overall direction we discern in the many somewhat disparate enterprises already under way, a description of an overall project on which many organizations around the globe have already embarked. And in yet another sense, casting a *Global Effort* as highly time-focused, pursued within the specific decade 2020–2030, looks very much like a plan, something we are already embarked upon and should continue pursuing.

This essay's account of a *Comprehensive Global Effort* can thus be read in at least three not fully distinct ways. It lies somewhere between a sheer thought-experiment ("What if the serious human infectious diseases could be brought under control?"); a factual account of events that are now taking place ("Look at all the remarkable progress that is going on!"); and a practical proposal with a concrete, dated plan ("What would it take to bring the serious human infectious diseases under control, and to do so—this is the visionary part—*by the end of the decade 2020–2030*?"). The power of a thought experiment is to help identify moral fault lines (as in our airport thought experiment), and the importance of a factual account of what is actually going on is to remind ourselves of the very substantial progress, as well as backsliding, that has been made so far. And the heuristic device of a time-pressured feature, of imagining the culmination of this *Effort* in a fast-approaching, specific, and limited period of time—the decade 2020–2030—emphasizes the real-world challenges of global coordination and cooperation, if that is what would be necessary to bring the serious human communicable diseases under control. But most important for our concerns here, this chapter's broader and far more realistic exploration of what is afoot in the new "marvelous momentum" of efforts to reduce the global burden of disease also involves exploring concrete moral claims about what would be required to make this immense global effort go *ethically* well.

Some authors suggest that the moment for such a project is already past. Robert Baker, for instance, contends that humankind has "squandered" the opportunity to

usher in a "Golden Age of protection from disease" (Baker 2007). But that does not preclude a renewed, reinvigorated, and better-orchestrated effort as a revitalized attempt, something we see as again under way.

Other global efforts are also beginning to attract at least some measure of global cooperation—for example, controlling global warming; rescuing endangered species; securing equitable access to water or establishing water justice; developing alternative energy sources; managing immigration; controlling drugs; and eliminating terrorism, ethnic cleansing, and war. But a common goal of the eradication, elimination, or full control of serious, human-affecting infectious disease may be, as we will consider later on, both more practicable and less controversial than these others, even though like them it may involve quite controversial policy initiatives.

In a *Comprehensive Global Effort*, coordination of effort or at least simultaneous effort on many different fronts is crucial, since many of the factors that need to be addressed are highly interrelated with others. Scientific advances accomplish little without infrastructure improvement, for example, or environmental control. Institutional cooperation and legal protections are inadequate in the face of cultural and religious attitudes that vilify carriers of infectious disease as sinful individuals, or characterize outbreaks of infectious disease as an appropriate scourge for sinful populations. To think about an emerging, overall, coordinated globe-wide project is to "think big" about all the factors across the board that affect how we might address a challenge to human well-being that had almost disappeared from ethical dialogue in the late 1960s and early 1970s, before renewed ethical debate with the emergence of HIV, even though advances like the development of new antimicrobials and the eradication of smallpox were proceeding apace. It is such an ongoing project that has now come into view again with real force, reenergized and far more publicly visible in the last seven or eight years, and that makes it imperative to "think big."

"Thinking Big," Both Practically and Ethically

A number of "think big" efforts toward reducing the global burden of infectious disease are already under way, practical efforts of a variety of sorts focusing on social realities and scientific gains. The United Nations Millennium Development Goals (MDG), for example, represent an effort to think globally about health and related problems (United Nations 2008). The Gates Foundation's Grand Challenges in Global Health Initiative is also global in scale: it seeks to achieve scientific breakthroughs against diseases that disproportionately affect the two billion poorest people on earth, though of course diseases like AIDS and tuberculosis can affect people everywhere. The Council of Science Editors has organized a global theme issue on poverty and human development involving more than 230 science and biomedical journals, focusing among other things on interventions to improve health among the poor (Flanagin and Winker 2007). These are all invaluable efforts involving the many, many parts of the overall picture, and they all "think big."

At the same time that practical efforts are converging in the effort to control infectious disease, there is an efflorescence of efforts to consider the ethical issues involved. With the exception of those directed to HIV/AIDS, most date from 1999 or later, and recent attention to the ethics issues in pandemic influenza planning has been particularly extensive. Documents like that from WHO by Coleman, Reis, and Croisier (Coleman et al. 2007) articulate policies; others, like the American Civil Liberties Union (ACLU) document authored by Annas, Mariner, and Parmet (Annas et al. 2008), vigorously critique policies already developed on the basis of ethical inadequacies. And a major effort has been mounted by the Bill & Melinda Gates Foundation to look specifically at the ethical issues in the emerging concern with global health: this is the ethical, social, and cultural program that is funded under the Grand Challenges in Global Health Initiative, designed to use bioethics considerations to assess the specific Grand Challenges projects that are planned or are currently under way (Singer et al. 2008). Elsewhere we document how infectious disease had been left out of bioethics during that new field's formative years (Battin et al. 2008, chapter 4); now it is moving back in, so to speak, with extraordinary rapidity, making up for a couple of decades of lost time.

However, much of the burgeoning new work in the ethics of infectious disease employs the conceptual categories of traditional bioethics that were developed without specific attention to the moral issues in transmissibility. To be sure, this may be perfectly adequate in addressing issues like caged field trials of genetically modified mosquitoes, as is the subject of one of the current projects under the Gates Foundation's Grand Challenges program, but the traditional approaches of bioethics' usual ethical framework within which projects are assessed needs, as we argued there, to be augmented and expanded.

Of course, many writers and theorists already instinctively appeal to both victim-related and vector-related concerns, but as far as we are aware none have done this explicitly or systematically in a way that would *guarantee* that both concerns would be addressed in any given issue. This is what we have sought to do with our PVV view. Hence, we like to think of our objective here in exploring the notion of a comprehensive global project as in concert with, and indeed admiring of, the many efforts now afoot to explore the ethical issues in infectious disease, but pushing them a good step further—a step we believe necessary for morally adequate reflection on a very broad scale.

What, then, would be involved in a *Comprehensive Global Effort for the Years 2020–2030 for the Eradication, Elimination, or Control of Infectious Disease*? We point to both practical and ethical issues that would arise along at least five different though interrelated "tracks": (1) What would be desirable in the spheres of national and international policy? (2) What would we need to bring about in terms of epidemiological and health care infrastructure? (3) What are the most crucial lines of pursuit in scientific development? (4) What would need to be thought about in light of religious, social, and cultural considerations? and 5) What would need to be developed as legal and social protections for individuals? These five are all critical areas for research and policy development, most of them interdependent upon each other, and all raising substantial ethical issues we will sketch here.

This *Global Effort* is not to be imagined as starting from zero. On the contrary, many of the critical areas in Tracks 1–5 are already well known to participants in current efforts to address infectious disease across the globe, from researchers and clinical health care providers to immense organizations concerned with global health. Indeed, everyone and every organization working in infectious disease participates in some part of the global project explored here, whether aware of the emerging comprehensive effort or not. It is already in progress—indeed, in full swing.

Global Efforts: Results So Far

Can we even imagine a *Comprehensive Global Effort for the Eradication, Elimination, or Control of Infectious Disease?* Indeed, in many respects the world is already halfway there, at least in developed countries. It is important to remember as we entertain the notion of a *Global Effort* the impressive list of infectious diseases affecting humans for which effective vaccines, treatments, or preventive measures have been developed. Some of these diseases have already been eradicated, eliminated, or brought under control in the wild, though for many methods for prevention and treatment are known but not available in much of the developing world.

Here is a snapshot taken at the current moment in history of our progress so far in bringing the serious human infectious diseases under control: it is a shifting picture and highly variable from one area to another, but a picture of extraordinary achievement just the same. Some is due to the development of effective vaccines or drugs, some due to quality-of-life improvements and infrastructure development, some due to effective preventative measures, and some due to accidents of geography or environmental change, as with alterations in the ranges of animal or insect vectors.

Here is a partial list of human diseases that have been eradicated, eliminated, or can be well controlled by vaccines or effective therapies. Among these are:

- Smallpox
- Leprosy
- Plague
- Yellow fever
- Pertussis (whooping cough)
- Syphilis
- Diphtheria
- Tetanus
- Rabies
- Measles
- Mumps
- Polio
- Varicella (chickenpox)
- Rubella (German measles)
- Invasive pneumococcal disease

- *Hemophilus influenzae* type B
- Hepatitis A and B
- Meningococcal meningitis
- Japanese encephalitis
- Seasonal influenza

Other infectious diseases, particularly those common in developing countries, have effective therapies or methods for control, but these controls have not been widely implemented. They include:

- Tuberculosis
- Malaria
- Trypanosomiasis (sleeping sickness, Chagas disease)
- Cholera
- The "neglected tropical diseases" for which effective oral treatments are already known (Reddy et al. 2008, 1911–1924):

  - Roundworm
  - Whipworm
  - Hookworm
  - Schistosomiasis (snail fever or bilharzias)
  - Elephantiasis
  - Trachoma
  - River blindness

Still other infectious diseases remain essentially uncontrolled or currently lack any effective vaccines or therapies, among them:

- Ebola
- Marburg
- HIV
- Dengue fever and dengue hemorrhagic fever
- West Nile virus
- Hantavirus
- SARS viruses
- Leishmaniasis (sandfly fever)
- Creuztfelt-Jakob Disease and variant Creutzfeldt-Jakob Disease
- Food-borne toxigenic E. coli
- Evolving highly antimicrobial-resistant strains of tuberculosis
- Influenza type A

So far, successes in reducing the burden of disease in the developed world have been remarkable. In the United States, the death rates for smallpox, diphtheria, and polio have declined by 100% since vaccines were approved; for another nine diseases, they have declined by 90% (McNeil 2007). To be sure, there have been major setbacks (like the reemergence of tuberculosis, polio, yellow fever, even plague), but in general progress towards the full control of infectious disease is astonishing—at least where it is fully implemented, as in the wealthy parts of the

world. In contemplating the possibility of eradication, elimination, or control of the serious human infectious diseases, it might be said, we are halfway there, at least in the developed world.

Human Health in Epidemiological Perspective

The already impressive successes of an emerging *Comprehensive Global Effort*, if we can think of them as part of a long-term effort, are after all evident in the history of demographic shifts in causes of human mortality. Up through the middle of the 19th century, everywhere in the world, parasitic and infectious diseases were the principal cause of human mortality (Olshansky and Ault 1987, 207–217). With the development of clean water, public sanitation, immunization, the germ theory of disease, hand washing by physicians, antibiotics, and many other factors, infectious disease (with the single exception of pneumonia) is not even on the standard list of the top ten causes of death in the developed world. At the same time, infectious diseases remain a major factor in the developing world, where death rates particularly for children remain high. Just a century or two ago, infectious and parasitic diseases were the way most people everywhere in the world died; in the developed world, they are a much reduced threat, and where they do kill, kill mainly the old. Infectious disease mortality in the United States has declined remarkably in the past century, and now represents a small percentage (<5%) of disability-adjusted life-years lost (Armstrong et al. 1999). The stark differences in life expectancy around the world, ranging roughly from a high of between 75 and 86 years for both sexes in Japan, Australia, Iceland, Canada, the Netherlands, Cuba, and the United Kingdom at the top end of the range, downward to 40–60 years in the poorer, developing nations, and in some countries, like Malawi, Mozambique, Zimbabwe, Zambia, still lower, to Sierra Leone, with a low of 37–40 years, is not just a matter of disparate human development indices but differential death rates from infectious disease (World Health Organization, data for 2005). A *Comprehensive Global Effort*, it is painfully obvious, has already been very largely successful in the developed world—this may be part of what has allowed the developed world to become developed—but has a long, long way to go in those countries left behind.

Is a *Comprehensive Global Effort* Realistic? On Eradication, Elimination, and Control

It is crucial in understanding any *Global Effort* to recognize the differences between eradication, elimination, and control. Complete eradication by eliminating entirely the pathogen which causes disease is realistic in only a small proportion of cases, those which involve human vectors only and no intermediate stages: e.g., smallpox, polio, measles, and tuberculosis. The eradication of all human infectious

disease—that is, completely ridding the world of all disease-causing pathogens in the wild—is not a realistic goal, since many human-affecting infectious diseases also have nonhuman vectors or reservoirs. Tetanus, for example, lives in the soil; so do the spores of coccidioidomycosis, a fungal infection responsible for valley fever (McKinley 2008). Malaria involves a transmission stage in mosquitoes; so do yellow fever, dengue fever, and many other arthropod-borne infectious diseases. Other common infections—such as staphylococcal skin infections, or peritonitis due to ruptured bowel—are due to organisms that we normally carry on our skin or in our gastrointestinal tracts, and attempts to eliminate one pathogen would be foiled by the rapid appearance of other potential pathogens to refill the microbial niche in the skin or gastrointestinal (GI) tract.

Furthermore, many pathogenic organisms do not require humans for their perpetuation and are not acquired from other humans. Elimination of these organisms in humans, for instance by means of universal immunization or effective treatment, would still not eliminate these organisms, and the diseases they cause will remain a continuing threat. Some human-affecting diseases also affect animals and are carried by animals—Rift Valley fever, for example—and unless contact between these animals and humans were completely interrupted, control of these diseases in humans could not be complete without achieving control in the animal population as well. Some pathogens affect both people and plants, like the bacterium *Burkholderia cepacia* (people and onions), which can be lethal for people with cystic fibrosis, or *Serratia marcescens* (people and squash plants), which reaches immunocompromised hospital patients through floral arrangements, salads, and intravenous tubes (Milius 2007, 251); it is hard to see how these pathogens could be entirely eradicated. And some infectious diseases, such as influenza and HIV, reappear in modified form and potentially require ongoing prevention or treatment in generation after generation. At this point in the human history of infectious disease, there is just one extant example of complete eradication: smallpox. But there are many examples of elimination, that is, reduction to a very low level, like leprosy, plague, and polio, the latter on the verge of eradication despite recent outbreaks. And there are many examples of full or nearly full control, at least in the developed world, where disease is preventable, treatable, or curable by means of immunization, antimicrobials, sanitation measures (e.g., clean water), or other effective prevention or treatment.

Of course, there is an immense gap between diseases which can be eliminated and diseases which are in fact eliminated. Leprosy, for example, falls in this category, as do many of the so-called neglected tropical diseases for which effective treatment is known but not widely available: here the gulf between the developed world and the developing world is at its greatest. It is already possible in principle, despite enormous practical obstacles, to reduce dramatically much of the huge burden of disease suffered by those in poorest parts of the globe, and as new diagnostic technologies, vaccines, and treatment modalities are developed, so does the likelihood of elimination or full control for many additional diseases.

Obviously, even in the developed world control of infectious disease will never be complete. There will always be newly emerging diseases: in recent years, some

39 new communicable diseases with the potential to become pandemic have jumped species, including SARS, monkeypox, and bird flu (Rubin 2008). The prospect of newly designed or already known pathogens used as bioweapons cannot be ruled out (Selgelid 2007; Zilinskas 2007). Climate change, settlement of newly cleared land, and warfare and its dislocations can also play a role in the emergence or evolution of disease.

Some theorists might argue that certain serious diseases should not be eliminated because they are useful in other respects, as when pneumonia serves as the "old man's friend," a bringer of death more easeful than that from other human maladies. Others might point to research suggesting that exposure to infectious disease has played a major role in mammalian evolution, resulting among other things in the development of the amniotic sac and other adaptive advantages (Zuk 2007), and thus argue that continuing exposure should not be eliminated, lest further evolutionary gains be lost. Still others claim that the overuse of antibacterial soaps and other "germ-proofing" methods results in higher rates of asthma and allergies. A *Comprehensive Global Effort* certainly would not seek to exterminate all parasites, fungi, bacteria, viruses, and prions (the microorganisms that affect human beings), since many are essential for human health, but only the pathogenic ones that do not have beneficial functions and are responsible for extensive human morbidity and mortality. It is this process of overcoming *disease* that we see as already well under way in any long-term *Comprehensive Global Effort*.

We may ask, then, phrasing the question in three ways that correspond to seeing a *Comprehensive Global Effort*—as a thought experiment, as a report of current activity, or as a plan—what would it be like if, what is happening that, or what do we need to do to try to achieve the eradication, elimination, or full control of serious human-affecting infectious disease, say within the decade 2020–2030, around the globe? The question, in each of these forms, is not just about what practical projects of research, policy development, or implementation would be most urgent, but also about what ethical issues most urgently require attention as a *Global Effort* proceeds.

We suggest five tracks along which to consider these questions.

Track 1: National and International Organizations and the Development of Collective Will

If a *Comprehensive Global Effort* is to succeed fully, it would be important to foster the cooperation of institutions and players of all sorts, public and private. Many are already committed—but not all. Thus a first part is to consider what sorts of institutions are critical to infectious disease control, which are helpful, which are problematic—and how the support of such institutions could be enlisted and maintained, or modified where it has been counterproductive. This is to seek to establish and maintain the collective, global will to try to reduce the global burden of infectious disease as low a level as possible. The practical challenge is to develop the global

political will to try to work together to bring infectious disease under control in the first place, and it is a substantial challenge. If the many sorts of institutions are all to cooperate, it would require laying aside infighting, reducing political competition, avoiding distraction by shifting from one to another "short-term numerical target" (Farmer and Garrett 2007), avoiding turf wars, and other things that could derail progress (Cohen 2006, 162–167). Could all these institutions contribute cooperatively in their myriad ways to a common project, even for just a decade? How such matters should be addressed is a crucial issue for reflection in the development of this track of a *Global Effort to Close the Book on Infectious Disease*. After all, the *Effort* cannot succeed, or succeed quickly, if some institutions undercut the efforts of the whole.

Track 2: Epidemiologic and Health Care Infrastructure

Track 2, epidemiologic and health care infrastructure, is widely recognized as indispensable in the control of infectious disease. The absence of adequate health care infrastructure, including the absence of adequate diagnostic and surveillance measures as well as adequate immunization and treatment measures, can contribute dramatically to the unchecked spread of infectious disease. An outbreak unnoticed (or ignored) can have an immense amplification effect down the road; the "stitch in time" approach to infectious disease is key to prevention, in that it is almost always easier to stop one case now than ten cases down the road—or a hundred, or a hundred thousand. Poverty and war have crucial amplifying effects: diseases that might be mild or resisted altogether by individuals who are healthy and well nourished may spread rapidly in disrupted conditions where people endure malnourishment, parasites, and chronic illness. Natural disasters can also produce similar effects, if populations are cut off from care, and if the conditions of the disaster—standing water after a flood, for instance—create risks of disease. Economic practices can also affect disease transmission: for example, the practice common in many developing countries that physicians see private patients rather than poor, charity ones, exacerbates disease transmission, since it is poor, charity patients who are most likely to be afflicted because of their crowded living conditions and lack of access to clean water and adequate sanitation.

Poverty, war, and natural disaster are also typically associated with inadequate infrastructure: for those who do become ill, health care is hardly available; clinics, if there are any, are overcrowded; personnel are inadequately trained and hopelessly stressed; medications are outmoded or unavailable. Poverty and war are often closely intertwined: northeast Kenya, for example, has a million refugees from Somalia, people for whom the risks of infectious disease are compounded over the already difficult lives they had previously led. Another 300,000 have been internally displaced following the postelection violence in early 2008, and the chief among the many health risks they face is cholera (Harvard World Health News 2008). Life in refugee camps or urban slums, often without adequate sanitation

facilities, is, as our PVV view might describe it, life most fully "enmeshed in the web of disease," life in which people are most obviously "way-station selves" as microorganisms travel unchecked among them. Thus, in seeking greater control of infectious disease, attention to social and sanitary infrastructure issues is crucial:

- Clean water
- Sanitation
- Waste disposal
- Control of insect and animal vectors (mosquitoes, fleas, rats, etc.)
- Control of environmental toxins
- Health-related transportation, including roads or airlifts and other ways of bring health care to people in remote or disrupted communities
- Enhancement of health care delivery systems, especially vaccine delivery systems, treatment facilities, and easy-access clinics
- Encouragement of use of low-tech, low-cost modalities for infectious-disease prevention: bed nets (Bradley 2007), water filters, "drinking straws," and pond attendants, etc.
- Development of novel health care delivery modalities, e.g., *accompagnateurs* (Farmer and Garrett 2007) as Partners in Health has utilized in HIV/TB treatment in Haiti
- Attention to the causes of poverty associated with infectious disease, particularly those associated with the neglected tropical diseases and with disease outbreaks among dislocated populations like refugees
- Attention to the causes of war, civil conflict, guerilla actions, and related hostilities that exacerbate the risks of infectious disease
- Rapid response to natural disasters, with particular attention to special characteristics of a disaster that might encourage the spread of disease

Ethical questions associated with this enormous variety of concerns might range from consideration of who should receive how many bed nets and what they may or may not do with them, to requiring contributions or labor for the installation of sanitary systems, to the very substantial privacy and confidentiality issues that arise with local and global surveillance systems. Modeling methods used in planning, whether for endemic disease in poverty and war or for outbreaks associated with pandemics of newly emerging diseases or in natural disasters, are of particular ethical significance under the PVV view, since they often incorporate assumptions about what levels of disease can be tolerated; the PVV view warns against cavalier acceptance of leaving a significant proportion—indeed, any proportion—of a population still subject to preventable or treatable disease, since that is to ignore the fact that those who suffer disease are indeed victims.

Particularly important under the PVV view is attention to how large-scale programs are formulated. Classic epidemiology tracks disease movement through populations. Research agendas focus on issues of particular salience in specific populations but leave aside others. Treatment programs often target just those populations or population subgroups at highest risk of contracting and transmitting disease. There are obvious advantages of design and efficiency here, but at some

moral cost. Our PVV view insists that those left outside these categories—people not in high-risk groups who nevertheless contract disease, people whose groups are not the focus of research efforts, and sufferers from "orphan diseases"—be recognized too, both in their own roles as vectors but especially as victims.

Track 3: Scientific Development

Effective control of human infectious disease cannot be possible without continuing scientific development. Examples of scientific efforts—many already well under way—that would be essential to achieving any measure of success involve better diagnosis, better treatment, better mechanisms for prevention, and better background science in the understanding microbial pathogenesis, defense mechanisms in humans, and evolutionary, genetic and other factors relevant to human vulnerability to infectious disease. The Gates Foundation's handsomely funded Grand Challenges in Global Health program already includes some 14 research incentives which serve seven long-term goals in global health: improving childhood vaccines, creating new vaccines, controlling insects that transmit agents of disease, improving nutrition to promote health, improving drug treatment of infectious diseases, curing latent and chronic infection, and measuring health status accurately and economically in developing countries (Singer et al. 2007). These are immense important goals; many others are in progress or remain to be developed. A group of comparatively realistic research goals would include:

- Improvement or development of rapid, reliable tests for all infectious diseases, based on PCR, proteomic, or nanotechnology methods:

  - Goal: 100% specificity, 100% sensitivity: 0 false positives, 0 false negatives, including field-usable tests available at point-of-care
  - Goal: rapid speed of identification, in minutes or seconds
  - Goal: low cost, easy use

- Improvement of genetic identification methods for pathogens and other means for transmission tracking

  - In humans
  - In animal vectors

- Development of improved methods of rapid identification of emerging diseases

Pathogen identification and disease diagnosis are crucial in prevention, and central to a *Global Effort* already under way. Particularly challenging scientific goals include treatment as well, especially since treatment possibilities change with the rapid replication rate of many infectious organisms, with the development of drug resistance, and other factors. A drug that may have worked in one context, like chloroquine for malaria, for example, may not work in other contexts or with the same disease in other regions (Bradley 2007); developing effective prevention

and treatment is an ongoing challenge. Other obviously crucial scientific goals include:

- Development of improved vaccines and vaccine administration and storage methods
- Development of improved antimicrobials and other treatment methods
- Development of safer insecticides and vector controls

The PVV view also urges that governments and entities recognize the hypothetical as well as actual reasons for support of scientific research and cooperation in a *Comprehensive Global Effort*: although epidemics may at the current historical moment seem particularly likely to afflict some countries or continents rather than others, when it comes to globally transmissible disease, it could be otherwise. After all, dengue may be spreading to areas that, it is claimed, are warming with global climate change, but influenza flourishes in colder weather, and we may be quite unable to predict the ranges of future, not-as-yet emerging diseases.

Track 4: Religious, Social, and Cultural Considerations

Track 1's concern with developing cooperation among the various major institutions of the world—governmental, corporate, private, intergovernmental, and so on—also included religious institutions. Inasmuch as religious traditions and their institutions influence much of what people in every part of the globe think about disease and also govern their disease-transmission behavior, from hand washing before meals to sexual contact, the participation of religious institutions is crucial to the success of a *Global Effort*. However, some religious traditions preserve scriptural or traditional characterizations of infectious disease as "scourge," as "punishment" that is divinely ordained, or as the product of wrong behavior in this or previous lives. Addressing these often archaic characterizations of infectious disease is of consummate importance in securing the cooperation of people and their religious institutions, often enormously powerful, around the globe.

Consider the various portrayals of leprosy or plague or other infectious diseases in the scriptures of religious traditions. In the Hebrew/Christian Bible, for example, God allows Satan to test the loyal Job with any hardship that is short of fatal, and Satan begins with infectious disease (perhaps leprosy or a staph infection?): Satan "smote Job with running sores from head to foot, so that he took a piece of broken pot to scratch himself as he sat among the ashes" (Job 2:7–9, New English Bible translation). In the Muslim *Hadith*, plague is described as "a means of torture which Allah used to send upon whomsoever He wished, but He made it a source of mercy for the believers, for anyone who is residing in a town in which this disease is present, and remains there and does not leave that town, but has patience and hopes for Allah's reward, and knows that nothing will befall him except what Allah has written for him, then he will get such reward as that of a martyr"—in other words, plague is a punishment, though it can also become a blessing for those who believe (al-Bukhari 1959).

In many religious traditions, the implication is that people or groups afflicted by disease deserve it in one way or another, and that such illnesses are a product of divine wrath visited upon them or perhaps an opportunity for spiritual growth.

Attitudes about HIV/AIDS or other STDs expressed in some contemporary religious groups sometimes construe contracting the disease as punishment for homosexuality, infidelity, promiscuity, or other sinful behavior, either of individuals or of groups. Fatalism may also be associated with religious views, as when it is held that the visitation of infectious disease is God's will and hence that nothing can be done about it. Both religious and cultural attitudes may be involved in ancient practices like belling lepers or shunning victims with pocks, boils, open sores, or other visible evidence of disease. In some traditions, such attitudes may include views that the afflicted not only deserve it but are "not our problem," that justice is being done and others have either no obligation to intervene, or no intervention is appropriate. Some religious groups appear to fear that attempts to reduce infectious disease transmission, especially of sexually transmitted diseases like HIV, might interfere with teachings prohibiting homosexuality or encouraging chastity. And some religious traditions value the contingency of human life *per se*, appearing to hold that efforts to forestall illness or delay death are contrary to divine plan.

Religious beliefs and attitudes can of course play a strongly positive role in encouraging cooperation with a societal project to protect the life and health of human beings. Religious commandments like "do not kill" and "respect life" speak in favor of bringing potential lethal infectious disease under control. Traditions which stress compassion and the relief of suffering would presumably also support the underlying concern of a *Global Effort*, to extricate humankind from the web of disease within which it is enmeshed. Some religious traditions stress the unity of human beings in divine creation; some stress stewardship of the environment and with it, concern for human health; some emphasize attitudes of caring, concern, and compassion for those who are ill. And many stress the value of sacrifice and dedicated work for the good of the community, a commitment believed to be viewed favorably by the divine or rewarded well in the next life. These are all attitudes that suggest that religious institutions might play a powerful role in engendering cooperation with a *Global Effort* by the world's faithful who subscribe to these views.

But not all religious views concerning infectious disease favor constructive cooperation. To challenge entrenched social or religious beliefs is never easy, and rarely fully successful. This is the issue our PVV view expects us to put on the table: that entrenched beliefs and practices may fail to regard people, both as individuals and in groups or populations, as both victim and vector at one and the same time, in ways that work to the detriment of all.

Track 5: *Legal and Social Protections for Individuals and Groups*

Our PVV view here also recognizes that a *Global Effort* for the control of infectious disease cannot satisfy the conditions of this view unless it attends to legal and social protections for individuals and groups, to ensure that neither

individuals nor groups are victimized by institutional measures, scientific research programs, infrastructure changes, or other matters that are part of the *Global Effort*. This is to recognize that, under our PVV view, "victimhood" can have a dual sense: a person or group, or entire population, may be the victim of a disease—this is the primary sense of "victim" in the PVV view—but may also be the victim, so to speak, of policies, programs, prejudices, and other matters associated with disease, or both.

Legal and social protections for individuals, groups, and populations, under our PVV view, should include at least:

- Development of rigorous local, national, and international protections for privacy and confidentiality of individual information in surveillance systems

  - In reporting of data
  - In contact tracing and transmission tracking
  - In follow-up for health care

- Development of policies concerning rights to privacy and/or confidentiality for information that poses a risk to other people, or a right to privacy in a public place
- Development of protections and systems for maximum communication among families and social groups during isolation, quarantine, home quarantine, or other restrictions in epidemics
- Development of protections for things that matter to people, e.g., pets and property
- Attention to animal rights and animal-welfare issues
- Erection of special protections for the least well-off (and most likely to be affected by infectious disease):

  - Refugees
  - Prisoners
  - The institutionalized, including those in mental institutions
  - The homeless
  - The elderly
  - Infants and children
  - People with disabilities, poor health, or compromised immune systems

As Michael Parker puts it, echoing the British pandemic plan, "Everyone matters" (Parker 2007). This notion is essential to our PVV view: while it recognizes that trade-offs between concerns like privacy and surveillance or confidentiality and interruption of transmission must sometimes be made, it still insists that policies not victimize or exempt those whom they affect.

A further area of concern about legal and social protections for individuals and groups involves attention to micro- and macroeconomic issues. What will be the impact of a *Global Effort* on all parties? Some concerns might involve those whose current income depends on treatment of infectious disease. After all, if a *Global Effort* were to succeed and the global burden of infectious disease dramatically reduced, this income would be eliminated. Who will be out of a job? Larger economic

concerns might focus for instance on the impact of higher rates of infant and child survival on domestic and social situations where poverty is severe, or on changed patterns of survival—reflecting the success of a *Global Effort* in reducing death rates—on economies around the world. There would presumably be relatively little effect on economies in the advanced industrial nations where infectious disease is already largely under control, but there could be dramatic effect in the worst-off nations of the world. Like everything else associated with it, a *Comprehensive Global Effort* should be subjected to adequate scrutiny in the decades prior to and during the culminating phase itself, with of course an eye to mitigating economic damage where it threatens to occur and but reaping the economic benefits of effective disease control as well.

A *Comprehensive Global Effort:* From Thought Experiment to Plan

Attempts to control infectious disease are already going on in many areas—indeed, in all five practical and policy tracks considered above—and they all raise important ethical issues. A *Comprehensive Global Effort for the Control of Infectious Disease*, incompletely developed as it is, is already well under way, whether we see it as a thought experiment, a description of current events, or a plan. Whichever way we interpret it, it requires us to consider the importance of not only global coordination and cooperation, but also the importance of coordinated, across-the-board *ethical* reflection. This ranges from reflection on comparatively focused issues like how to balance considerations of confidentiality versus public interest, how to weigh the impact of mandated treatment, or how to prioritize access to prevention and care in epidemics, to the deeper but at the moment more diffuse sorts of philosophical issues, such as whether attempts to control infectious disease should be given priority over attempts to control cancer or whether bioweaponry is intrinsically worse than conventional arms. In part because attention to the full control of infectious disease on a global scale has not so far been unified, the ethical issues each distinct effort raises have not been unified either, and have to a considerable extent been treated in comparatively isolated, discrete, "siloed" ways, even now that they are finally coming to be discussed at all in bioethics and other fields. This is not to say that ethical issues are to be viewed in a monolithic way, but rather that reflection on them must include understanding them in the larger context of a world in which we are "all in this together," all potentially victims and vectors of transmissible infectious disease.

No writer, as far as we are aware, is currently advocating the kind of universal surveillance or mandated treatment imagined in our airport thought-experiment, and no writer is advocating a decade of intense dedication to infectious disease control. But part of the point of a thought experiment like that is to test the ethical challenges to be faced in the real world, not just in a fictional one, and hence the challenges that would and do arise in what we see as an already-emerging

Comprehensive Global Effort. Ethical reflection in the context of infectious disease, we have been arguing all along, must be far broader than it has been, even during the efflorescence of the last seven or eight years—that is why we appeal not only to a limited thought-experiment about airport surveillance but to the much broader constellation of developments we have called an emerging *Comprehensive Global Effort for the Control of Infectious Disease*.

If a *Global Effort* as imagined here seems too grand—an overly far-fetched thought experiment, a misdescription of current reality, or an unworkable concrete plan—imagine what is involved in trying to extricate the globe from any *one* of the particularly serious diseases that are currently widespread—say, HIV/AIDS, or tuberculosis, or malaria. These are all recognized as devastating. AIDS has already killed 19 million people and, as of 2007, another 33.2 million are infected with the HIV virus. Tuberculosis infects or has infected an estimated 30% of the global population and kills about 2 million people a year. Worldwide, malaria infects between 350 and 500 million people every year, and between 2 to 3 million die from it—90% in Africa, where it is estimated that one child dies from malaria every 30 seconds (Packard 2007, xvi). The new movement for global health, building on the steady work of the WHO and others over many years and galvanized less than a decade ago by the remarkable private contribution of the Gates Foundation, is already committed to the elimination of these diseases; it has become a top global priority. Yet—here is the key to our project in this "think big" essay—eliminating any one of these diseases will raise virtually *all* the issues we have posed in the five tracks outlined above. So would eliminating all three. Indeed, for any disease or group of diseases for which we might consider trying to achieve global or even local eradication, elimination, or control, issues about institutional cooperation, infrastructure improvement, scientific development, religious and cultural attitudes, and social and legal protections are all relevant. Comprehensive ethical reflection is crucial in such an enterprise as well: while it is important to be sensitive to the specific, factual features of any given case, we cannot do ethics piecemeal, as an iterated effort one disease after another for the indefinite future, or in response to one new technology, or one political challenge, or one scientific development at a time, without a larger picture of human embeddedness in webs of mutual disease transmission, within which they occur.

"Think Big" thought experiments are unlimited in scope, in this case fueled by an elective optimism and bounded only by the limits of plausibility in assembling the resources of the world to confront one of its most pervasive problems. We can imagine, as we have said, other *Global Efforts* directed towards other global problems—climate change and global warming, endangered species rescue, water justice, immigration management, global drug control, and so on. But the vision of a *Comprehensive Global Effort for the Years 2020–2030 for the Eradication, Elimination, or Control of Infectious Disease* may be, in contrast, simpler: its overall purpose of reducing the burden of infectious disease may be less controversial; its methods are not technically impossible; its science is reasonably well understood; and it does not require the change of institutions, only coordination and cooperation. Imagining such a project is of course to "think

big," but we can certainly imagine what this project would take, as the culmination of the efforts of several centuries, to achieve within a single decade a goal with which the fate of humankind might be dramatically improved. There is no way to guarantee that it would succeed. But it is a project already well under way, since the time of Jenner and with the best efforts of dedicated researchers, clinicians, and workers in public health. There is no practical or moral reason not to undertake this project, though plenty of reason to be cautious about how to do so—that is what we have tried to explore.

There is another, darker reason for exploring the practical and ethical issues in the *Global Effort* in this comprehensive way. A *Global Effort*, or even just continuing ordinary efforts to control infectious disease, might contain repressive, biased, insensitive, or otherwise morally indefensible elements, particularly if it were pursued under a tight time schedule by zealous institutions or highly competitive players. That there is a current efflorescence of ethical reflection does not entail that the various components of the overall global effort will go ethically well, and ethical reflection by itself will not prevent abuse. It is important to understand how even an admirable project with a highly desirable goal—extricating humankind from the web of infectious disease—could go wrong, that is, how it could be done, but not done well. It remains to look at a variety of policies of the sort that might be involved in a *Global Effort* to see what can go wrong with them as well as right, using our PVV view as a tool for examining actual, real-world policies as a way of thinking about larger aims.

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