

PART II

SECTORAL FAULT LINES

**EPIDEMIC DISEASE: A WILD CARD IN CHINA'S
ECONOMIC FUTURE?**

Is communicable disease a factor that might seriously impede China's economic ascent over the next decade or two? Could the outbreak and unchecked spread of epidemic illness—in particular, HIV/AIDS—in the years immediately ahead prove so devastating in and of itself as to alter China's expected development trajectory?

These are questions that demand highly speculative responses—and such responses are intrinsically problematic. Conjectures about momentous but as yet entirely hypothetical future contingencies can be unsatisfying and unconvincing, precisely to the degree that they lack rigor and empirical support. These sorts of contingencies are therefore perhaps best explored through what might be termed “rigorous speculation.”

Rigorous speculation about prospective adverse economic consequences for China from lethal infectious contagion would require us to focus upon a number of topics. First, we must outline China's performance in improving local health levels over the past half century and how that performance has affected infectious and parasitic disease. Second, we must attempt to describe China's current health profile (and the role of communicable illness within the overall profile) and to place that profile in international perspective. Third, we must attempt to describe plausibly the reasons (if any) that an upsurge of infectious disease could be expected in modern-day China. Fourth, we must try to model plausible trajectories for any such epidemic outbreaks. Finally, we must attempt to think through the sorts of costs—and attempt to describe the probable magnitudes of those

same costs—that would be visited upon China by the hypothesized upsurge in epidemic disease. This chapter will briefly address each of the aforementioned topics.

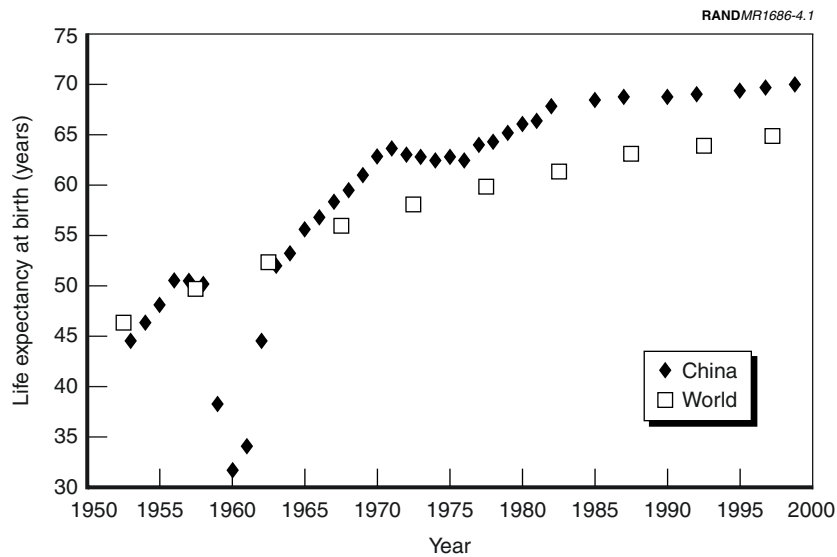
CHINA'S HEALTH PROGRESS SINCE THE "LIBERATION": A LONG MARCH AGAINST INFECTIOUS AND PARASITIC DISEASE

To this very day, China's demographic data are distinctly limited: Birth and death registration are nearly complete only in some major urban areas, and the quality of other demographic data (such as census returns and national surveys) is still a matter of discussion among foreign specialists.¹ Such data questions notwithstanding, there is no doubt that China has dramatically transformed health conditions and mortality risks since the Chinese Communist Party's official Liberation of the Mainland on October 1, 1949. Figure 4.1 illustrates China's changing health situation, using the summary index of estimated life expectation at birth. In the early 1950s, according to reconstructions by demographer Sheng Luo, life expectancy in China was under 45 years; by the year 2000, according to projections by the World Bank, it was about 70 years.² By those figures, life expectancy in China jumped by over a quarter century in less than two generations. Reconstructions by the United Nations Population Division imply an even greater improvement in life expectancy: an increase of about 29 years over the course of four and a half decades, from about 41 in 1950–1955 to about 70 in 1995–2000.³ If we were to use the Liberation as the starting point, China's long-term performance might look even more striking: According to internal but not im-

¹For contrasting assessments, see Jean-Clause Chesnais and Laurent Murawiec, "China's Statistics: A Hologram of Errors," Paris: Institute National d'Etudes Demographiques, unpublished paper; and William Lavelly, "First Impressions of the 2000 Census of China," *Population and Development Review*, Vol. 27, No. 4, December 2001, pp. 755–770.

²World Bank, *World Development Indicators 2001* (CD-ROM), 2001a.

³United Nations Population Division, *World Population Prospects: The 2000 Revisions* (CD-ROM), New York, 2000.



SOURCE: Sheng Luo, "Reconstruction of Life Tables and Age Distributions for the Population of China, by Year, from 1953 to 1982," New York: United Nations, World Population Prospects, 2000 revision.

Figure 4.1—Life Expectancy Circa 1950–2000: China Versus the World

plausible official calculations, China's life expectancy at birth in 1949 was only 35 years—suggesting as much as a 36-year surge between 1949 and 2000.⁴

The road to low mortality in China, we should note, was not an uninterrupted one: rather, after the "Great Leap Forward" campaign of 1957–1958, China plunged headlong into catastrophic famine, as reflected by the collapse of life expectancy in the 1959–1962 period in Figure 4.1.⁵ Yet if we compare circumstances in the early 1950s with those in the late 1990s, we can see that China's long-term improve-

⁴*Xinhua*, December 12, 2000; reprinted as "Infectious Diseases Drops [sic] in Past 50 Years, Raising Life Span by 36 Years in PRC," in U.S. Foreign Broadcast Information Service (hereafter, FBIS), FBIS-CHI-2000-1212, December 12, 2000.

⁵For an account of that disaster, consult Jasper Becker, *Hungry Ghosts: Mao's Secret Famine*, New York: Free Press, 1997.

ments in life expectancy were greater than those for the rest of the world taken as a whole. In other words, in the early 1950s, expectation of life at birth in China was below the world average, whereas it was about four or five years above the world's average by the late 1990s.

Communist China's progress in improving the survival schedules for its general population can be viewed in large measure as the consequence of a successful long-term process of controlling infectious disease. Although China itself lacked comprehensive and reliable cause-of-death statistics in the 1950s (as it does today), a strong and international correspondence between overall mortality levels and cause-of-death structures has been established through data from other countries (both Western and non-Western).⁶ According to those modeled patterns, a reduction of age-standardized death rates from about 25 per 1,000 to about 10 per 1,000—roughly speaking, China's accomplishment between the early 1950s and the late 1990s—would be attributed overwhelmingly to the decline in deaths from infectious and parasitic disease: influenza, tuberculosis, and cholera, among many others.⁷

Thus, the very fact that China has gone from being a high-mortality country to a low-mortality country can be taken in and of itself as powerful evidence that China has effectively checked and suppressed epidemic disease. Beijing's own rendition of that record may not be far from the mark:

Before 1949, people were severely affected by epidemics and varieties of endemics due to lack of medical care. Diseases such as cholera, smallpox, diphtheria, typhoid and malaria plagued the country and threatened many lives in the first half of the century. . . . In the past 50 years, the nation has made great achieve-

⁶Samuel H. Preston and Verne E. Nelson, "Structure and Change in Causes of Death: An International Survey," *Population Studies*, Vol. XXVIII, No. 1, March 1974, pp. 19-51.

⁷Preston and Nelson's work suggests that reduced mortality from infectious disease would be predicted to account for over two-thirds of an overall decline in the standardized death rate, from 25 per 1,000 to 10 per 1,000. Most of the remainder, according to their model, would be attributed to reduced deaths from "other and unknown" causes—and some important part of that remainder might also be related to undiagnosed infectious disease.

ments in building up its Medicare system. . . . Infectious diseases like smallpox and measles have been wiped out in China and chin-cough, diphtheria and poliomyelitis are under control.⁸

Although much of Communist China's progress against infectious and communicable disease may have been registered in the Maoist era,⁹ morbidity and mortality due to such diseases have continued to decline after the historic December 1978 turn in official economic strategy.

With respect to mortality, for example, Judith Banister has noted that age-specific death rates for Chinese children in the age 1–4 cohort fell by half between 1981 and 1995; she attributes this drop to both “a national campaign to immunize a very high proportion of children against the major diseases of childhood” and “improvements in rural water supplies [which reduced the risk of child death from] dysentery, diarrhea, typhoid, cholera and intestinal parasites.”¹⁰

Other indicators of epidemic and communicable disease have signaled continuing, and sometimes major, improvement in the Deng and post-Deng era. Between 1983 and 1997, for example, the annual number of cases of malaria reported to the World Health Organization (WHO) fell in China by about 90 percent, from about 265,000 to about 27,000.¹¹

CHINA'S CURRENT HEALTH PROFILE IN INTERNATIONAL AND GEOGRAPHIC PERSPECTIVE

To appreciate the risk that infectious and parasitic diseases (including epidemic diseases) currently pose to public health in China, we can take two separate but related approaches. First, we

⁸*Xinhua*, December 10, 2000; *Xinhua*, December 12, 2000 (reprinted as “Infectious Diseases Drop in Past 50 Years, Raising Life Span by 36 Years in PRC,” FBIS-CHI-2000-1212, December 12, 2000).

⁹See Judith Banister, *China's Changing Population*, Stanford, Calif.: Stanford University Press, 1987, especially Chapters 3 and 4.

¹⁰Judith Banister, “Population, Public Health and the Environment in China,” *China Quarterly*, December 1998, pp. 986–1015.

¹¹“Malaria, 1982–1997,” *Weekly Epidemiological Review*, Vol. 74, No. 32, 1999, pp. 265–270.

can cast the issue in international perspective; thereafter, we can examine the issue in Chinese domestic, geographical perspective.

An international perspective can be gleaned from some of the work of the WHO. Since the early 1990s, as part of a major effort to quantify the “global burden of disease,” WHO researchers have been striving to estimate both detailed cause of death patterns for major regions of the world and also “disability adjusted life years” (DALYs)—a new composite measure reflecting the effects of mortality plus illness plus injury—for worldwide populations.¹²

That research project is controversial, and its findings are not universally accepted by specialists.¹³ Considerable surmise was required to present comprehensive estimates of cause of death for regions where mortality registration is far from complete; moreover, any metric weighting the “burden of disease” necessarily relies upon both important and inescapably arbitrary assumptions. Whatever their shortcomings, the WHO “global burden of disease” numbers are nevertheless illustrative—and thus informative for our purposes.

Table 4.1 depicts the WHO's estimate of the proportion of overall deaths in 1998 due to specific diseases in China and three other regions of the world. The first comparator is India—Asia's other demographic giant and arguably a rising economic and geopolitical power in its own right. The second grouping is the High-Income WHO Member States: the roughly 900 million persons living in North America, Western Europe, Japan, Australia, New Zealand, and a few other, smaller societies.¹⁴ The final grouping is the collectivity of Low- and Middle-Income WHO Europe member states: This group-

¹²See, World Bank, *World Development Report 1993* New York: Oxford University Press, 1993; and Christopher J. L. Murray and Alan D. Lopez, eds., *Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability for Diseases, Injuries and Risk Factors in 1990 and Projected to 2020*, Cambridge, Mass.: Harvard University Press, 1996.

¹³For critiques of the approach and the work, see Kenneth C. James and Susan D. Foster, “Weighing Up Disability,” *Lancet*, Vol. 354, July 10, 1999, pp. 87–88; and Sudhir Anand and Kara Hanson, “Disability-Adjusted Life Years: A Critical Review,” *Journal of Health Economics*, Vol. 16, No. 6, December 1997, pp. 685–702.

¹⁴Israel, Hong Kong, Singapore, a few small Middle East oil-exporting states, and a handful of small, island societies from the Caribbean, the Mediterranean, the Indian Ocean, and the Pacific.

ing essentially demarcates the post-communist states of Europe (i.e., the former Soviet Bloc, the former Yugoslavia, Albania),¹⁵ with the Russian Federation itself accounting for over a third of the collectivity's total population.

A number of interesting differences between China and these three other major population groupings are suggested by Table 4.1 (among them, that injuries and respiratory diseases may figure much more prominently in China's own particular patterns of death). But our focus in this chapter is on the risk of death from infectious and parasitic ("communicable") illness.

According to the WHO estimates, communicable conditions accounted for about 5 percent of China's fatalities in 1998. What does that proportion signify? On the one hand, it would be distinctly greater than the negligible 1.5 percent of high-income country deaths attributed to infectious and parasitic disease. On the other, it would be vastly less than the roughly 23 percent of India's mortality attributed to communicable conditions. From the standpoint of mortality structure, the role of infectious and parasitic illnesses in China's overall death patterns looks closest to that of the former Soviet Bloc, although communicable disease would appear to account for a slightly higher share of overall mortality in the former than the latter (5 percent versus 3.5 percent).

If the WHO figures are to be trusted, as of 1998 China's primary infectious cause of death was tuberculosis, accounting for just under 3 percent of total mortality; China's five leading infectious/parasitic causes of death accounted for 4.4 percent of total deaths. In India, by contrast, the top five communicable diseases accounted for about 19 percent of overall mortality—about four times the share in China; in

¹⁵Two former communist regions are counted within High-Income Europe: the former German Democratic Republic (now the "new Federal States" in the Federal Republic of Germany) and Slovenia from the former Yugoslavia. Further, one never-communist country is included in WHO's Low- and Middle-Income Europe taxonomy: Turkey. Turkey, though, accounts for less than a seventh of the total population of that grouping. Low- and Middle-Income Europe therefore is, for most intents and purposes, a proxy for post-communist Europe.

Table 4.1
Mortality Structure by Cause of Death: China and Selected Regions, 1998
 (percentage of total deaths by cause)

Disease	China	India	High-Income WHO Member States	Low- and Middle-Income Europe
Communicable diseases, maternal, perinatal, and nutritional (of which, infectious and parasitic diseases)	11.3	42.8	6.3	9.4
Tuberculosis	4.9	22.7	1.5	3.5
STDs excluding HIV	2.8	4.5	0.2	1.0
HIV/AIDS	0.0	0.6	0.0	0.0
Diarrheal diseases	0.1	1.9	0.4	0.1
Childhood diseases	0.7	7.6	0.1	1.1
Meningitis	0.3	4.6	0.1	0.6
Hepatitis	0.3	0.4	0.1	0.2
Malaria	0.3	0.2	0.1	0.1
Tropical diseases	0.0	0.2	0.0	0.0
Leprosy	0.0	0.3	0.0	0.0
Dengue	0.0	0.0	0.0	0.0
Japanese encephalitis	0.0	0.1	0.0	0.0
Trachoma	0.0	0.0	0.0	0.0
Intestinal nematode infections	0.0	0.0	0.0	0.0
Other infectious diseases	0.1	0.0	0.0	0.0
Maternal conditions, perinatal conditions, nutritional deficiencies	0.3	2.2	0.6	0.4
Noncommunicable conditions	2.9	9.0	1.0	2.5
Malignant neoplasms	76.5	47.9	87.4	80.8
	19.8	7.0	25.1	14.7

Table 4.1—continued

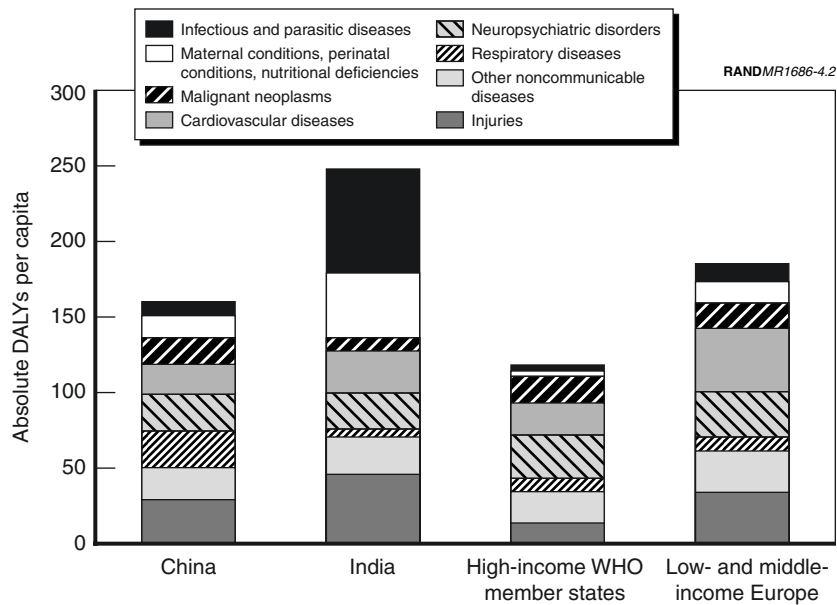
Disease	China	India	High-Income WHO Member States	Low- and Middle-Income Europe
Cardiovascular diseases	31.7	30.2	44.7	54.1
Ischaemic heart disease	9.5	15.8	23.5	26.9
Cerebrovascular disease	15.8	6.0	11.1	15.5
Other cardiac diseases	6.5	8.5	10.2	11.7
Neuropsychiatric disorders	1.0	1.1	2.8	1.6
Respiratory diseases	15.9	3.0	4.9	4.2
Other noncommunicable diseases	8.1	6.5	9.9	6.2
Injuries	12.2	9.9	6.2	9.8
Unintentional	7.1	7.7	4.1	5.6
Road traffic accidents	1.9	2.3	1.8	2.0
Poisoning	0.7	0.3	0.2	0.9
Falls	0.8	0.5	1.0	0.6
Fires	0.3	1.4	0.1	0.2
Drowning	1.5	1.0	0.2	0.5
Other unintentional injuries	2.0	2.1	0.9	1.3
Intentional	5.1	2.1	2.1	4.2
Self-inflicted	4.4	1.3	1.6	1.9
Homicide and violence	0.6	0.8	0.5	0.9
War	0.0	0.0	0.0	1.4

SOURCE: World Health Organization, *The World Health Report 1999*, Geneva, Annex Table 2.

post-communist Europe, the corresponding share was 3 percent, as against under 1 percent for the high-income countries.

The WHO's DALY is intended to reckon to aggregate mortality, illness, and disability into an internationally comparable index. The WHO's estimates of per-capita DALYs in 1998 for China and the three other groupings under consideration are shown in Figure 4.2.

China's overall health profile, according to these numbers, is much better than India's—and differences in the burden of illness due to infectious and parasitic diseases are said to account for most of that discrepancy. Interestingly, WHO numbers suggest that China's overall burden of disease is somewhat lower than that of post-communist Europe, although the proportion of the overall burden



SOURCE: World Health Organization, *The World Health Report 1999*, Geneva, Annex Table 2.

Figure 4.2—WHO-Estimated Burden of Disease by Cause and Region, 1998

due to communicable disease is said to be roughly comparable. (Not surprisingly, China's per-capita DALY is still substantially higher than that computed for high-income Western countries, as is its estimated burden of infectious and parasitic disease.)

Table 4.2 presents the WHO's 1998 per-capita DALY estimates for infectious and parasitic disease from Figure 4.2 in greater detail. In absolute terms, in this calculus, the overall burden of infectious and parasitic disease is said to be about seven times as high in India as in China, and about a fifth lower in Low- and Middle-Income Europe. On a per-capita basis, by these calculations, the top five infectious and parasitic diseases result in about one-third more DALYs in post-communist Europe than in China—and about seven times more in India.

To judge by these WHO calculations, contemporary China has made very significant progress in suppressing communicable disease and has attained a health profile with respect to infectious and parasitic illnesses that is unusually favorable for a country of its income level. If the WHO figures are roughly accurate, indeed, China's current infectious disease profile might be likened to that of the European region: with a burden of communicable illness somewhere between that of Western and Eastern Europe.

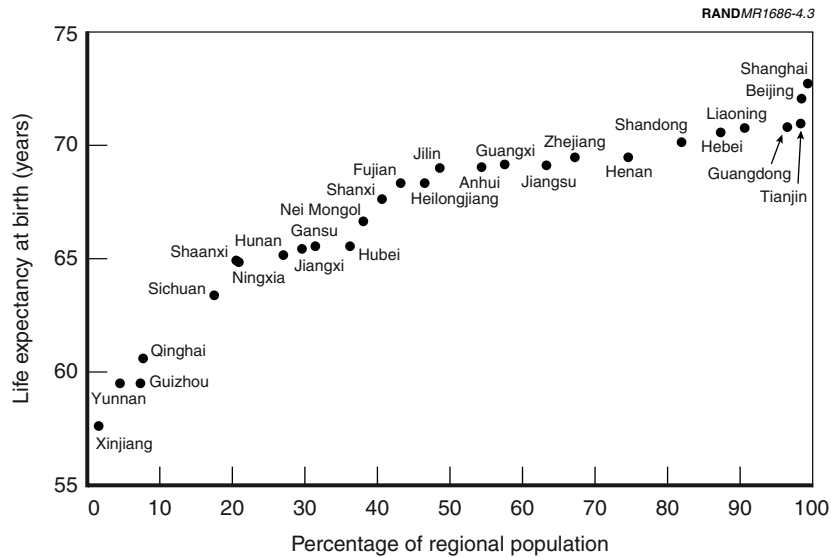
We must remember that, in an important sense, China is an arithmetic average of disparate components—and those disparities also appear in the realm of health. Figure 4.3 makes the point: It outlines the provincial distribution of life expectancy for the Chinese population as of 1982, as estimated from the 1982 Chinese Census.¹⁶ (Perhaps surprisingly, little in the way of research has been done on

¹⁶Data derived from Judith Banister, *China's Changing Population*, Stanford, Calif.: Stanford University Press, 1987; and Hongsheng Hao, Eduardo Arriaga, and Judith Banister, "China: Provincial Patterns of Mortality," paper presented at the Seminar on Mortality and Morbidity in South and East Asia, Beijing, August 29–September 2, 1988.

Table 4.2
WHO-Estimated Burden of Infectious and Parasitic Diseases by Cause and Region, 1998

Disease	China		India		High-Income WHO Member States		Low- and Middle-Income Europe	
	Thousands of DALYs Per Capita	% of Total DALYs by Cause	Thousands of DALYs Per Capita	% of Total DALYs by Cause	Thousands of DALYs Per Capita	% of Total DALYs by Cause	Thousands of DALYs Per Capita	% of Total DALYs by Cause
Infectious and parasitic diseases	9.6	5.8	68.8	25.1	3.3	2.8	12.1	6.3
Tuberculosis	3.1	1.9	7.7	2.8	0.1	0.1	1.8	0.9
STDs excluding HIV	0.1	0.1	5.0	1.8	0.5	0.4	1.1	0.6
HIV/AIDS	0.2	0.1	5.7	2.1	1.1	0.9	0.3	0.2
Diarrheal diseases	2.0	1.2	22.4	8.2	0.4	0.3	4.3	2.2
Childhood diseases	0.9	0.5	14.7	5.4	0.5	0.4	2.5	1.3
Meningitis	0.7	0.4	1.2	0.4	0.1	0.1	0.5	0.3
Hepatitis	0.4	0.2	0.3	0.1	0.1	0.1	0.2	0.1
Malaria	0.0	0.0	0.6	0.2	0.0	0.0	0.0	0.0
Tropical diseases	0.2	0.1	3.3	1.2	0.0	0.0	0.1	0.1
Leprosy	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0
Dengue	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0
Japanese encephalitis	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Trachoma	0.3	0.2	0.0	0.0	0.0	0.0	0.2	0.1
Intestinal nematode infections	0.9	0.5	0.8	0.3	0.0	0.0	0.1	0.0
Other infectious diseases	0.6	0.3	6.4	2.4	0.5	0.4	1.0	0.5

SOURCE: World Health Organization, *The World Health Report 1999*, Geneva, Annex Table 3.



SOURCES: Judith Banister, *China's Changing Population*, Stanford, Calif.: Stanford University Press, 1987; Hongsheng Hao, Eduardo Arriaga, and Judith Banister, "China: Provincial Patterns of Mortality," paper presented at the Seminar on Mortality and Morbidity in South and East Asia, Beijing, August 29–September 2, 1988.

Figure 4.3—Percentage of Regional Populations by Life Expectancy: China, 1982

overall mortality disparities in China for more recent years;¹⁷ nonetheless, though the specific numbers in Figure 4.3 are by now somewhat outdated, the general patterns highlighted still prevail.)

As of 1982, China's healthiest region (Shanghai) is thought to have enjoyed a life expectancy at birth roughly 15 years higher than its

¹⁷One exception is Hongsheng Hao, "Trends and Geographic Differentials in Mortality," in Xizhe Peng, with Zhigang Guo, eds., *The Changing Population of China*, Malden, Mass.: Blackwell Publishers, 2000, pp. 34–50, which estimates provincial life expectancy on the basis of the 1990 Chinese Census. Official data on provincial life expectancies are available from Chinese statistical compendia; but those figures are not thought to make adequate adjustments for underreported mortality.

least healthy province (Xinjiang). (Note that Tibet is excluded from the calculations in Figure 4.3.) In regions accounting for roughly a fifth of China's total population, life expectancy then was 70 or higher; in another fifth, it was 65 or lower. Generally speaking (to go by the proxy of life expectancy) the health situation was best in the country's major municipalities and along the coast; overall health conditions were poorer in the inland provinces—and in more rural regions.

It would be reasonable to assume that the distribution of the communicable disease problem in China follows the same general pattern: In other words, we may presume that the current risk of epidemic, infectious, and parasitic disease is distinctly higher for the hundreds of millions of Chinese in rural regions or inland areas than it is for those in urban centers and coastal zones.

PROSPECTS FOR EPIDEMIC DISEASE IN CONTEMPORARY CHINA: THE RISKS OF BEHAVIOR-BORNE COMMUNICABLE ILLNESSES

China's health situation today is by no means ideal. Serious problems with infectious disease (most notably tuberculosis, which reportedly still claims 250,000 lives a year in contemporary China) assuredly persist.¹⁸ The extensive if rudimentary socialized health care system of the Maoist era has given way, under the Deng era's economic reorientation, to a system that is largely pay for service, and full of coverage gaps, especially in rural areas.¹⁹ With the aging of China's population, moreover, the question of how to finance medi-

¹⁸*Xinhua*, April 1, 2000, reprinted as "China Conducts TB Epidemiological Survey," FBIS-CHI-2000-0401, April 1, 2000; *Xinhua*, March 19, 1999, reprinted as "Ministry: 250,000 Die Annually from Tuberculosis," FBIS-CHI-1999-0319, March 19, 1999; *Xinhua*, March 25, 1998, reprinted as "China: New Hepatitis Virus Confirmed in China," FBIS-TEN-98-084, March 25, 1998; and *Xinhua*, April 7, 1997, reprinted as "CHINA: Official on Prevention, Treatment of Diseases," FBIS-TEN-97-004, April 7, 1997.

¹⁹See, for example, Marilyn Beach, "China's Rural Health Care Gradually Worsens," *Lancet*, Vol. 358, August 18, 2001, p. 567; Gerald Bloom and Shenglan Tang, "Rural Health Prepayment Schemes in China: Towards a More Active Role for Government," *Social Science and Medicine*, Vol. 48, No. 7, April 1999, pp. 951–960; and World Bank, *China: Long-Term Issues and Options in the Health Transition*, Washington, D.C.: World Bank, 1992.

cal treatment for chronic conditions and diseases of the elderly—largely unresolved today—will become increasingly pressing.²⁰

For all those shortcomings, however, China's public health performance must be recognized for what it is: an unusually far-reaching achievement for a country with such a low level of per-capita income. Whatever the limitations of the Chinese public health apparatus, furthermore, China has clearly been able to control and gradually suppress the sorts of epidemic, infectious, and parasitic diseases that had afflicted its populace so sorely in earlier times. China appears to have a fairly workable model in place for dealing with waterborne, airborne, and food-borne infections.

Consequently, to posit a devastating upsurge of traditional infectious and parasitic illnesses (e.g., tuberculosis, influenza, hepatitis, malaria, meningitis, and the like) in China in the years ahead would seem to require the presumption that the mechanisms that have until now brought those afflictions so largely under control in contemporary China would suddenly suffer a systematic breakdown.

A public health disaster in China could surely follow a major systemic dislocation—for example, a collapse of central administrative authority, attended by a neglect of public health capabilities and an economic upheaval. But such a hypothetical public health disaster would be entirely contingent upon exogenous political shock—and although the unleashed health troubles might contribute to the country's consequent economic woes, they would simply be a "second-order effect."

Yet China's quite impressive record to date in checking epidemics and communicable diseases does not necessarily mean that newly emerging epidemics will be handled with equal efficacy under conditions of continuing political order. For the epidemic threats looming on the Chinese public health horizon look to be *behavior borne*, and behavior-borne epidemic disease may be more difficult for the Chinese health system to contain. The primary behavior-borne epi-

²⁰See World Bank, *Financing Health Care: Issues and Options for China*, Washington, D.C.: World Bank, 1997.

demic threat on the horizon today is, of course, HIV/AIDS (human immunodeficiency virus/acquired immunodeficiency syndrome).²¹

As is well known by now, HIV/AIDS is principally transmitted through human-to-human body fluid transfer (principally by blood, through sexual contact or intravenous exchange, although it may also be transmitted to infant in utero or through breast-feeding). A lentivirus (i.e., slow gestating virus), HIV gradually destroys its human host's immunosystem, so that the victim succumbs to an ultimately lethal bout of any of a number of opportunistic diseases. At this writing, there is no known cure for HIV/AIDS—nor has research for an effective preventive vaccine as yet yielded practical results.

The literature on the HIV/AIDS problem in China is by now immense.²² To summarize briefly the state of knowledge about the

²¹For a brief exposition on why behavior-driven epidemics may be intrinsically more difficult to control than “traditional” epidemics, see John C. Caldwell, “Rethinking the African AIDS Epidemic,” *Population and Development Review*, Vol. 26, No. 1, March 2000, pp. 117–135.

The analysis in this chapter proceeds on the assumption that HIV/AIDS is and will remain the primary infectious disease threat to public health in China over the next decade and a half. Implicit in this assumption are two subsidiary presumptions: (1) that a medical breakthrough leading to an inexpensive cure for HIV/AIDS will not take place in the period under consideration; and (2) that a hitherto unknown infectious disease will not displace HIV/AIDS in terms of lethal potential in the coming decade and a half.

²²For a sample of background materials from the press and more specialized journals, see Nicholas Eberstadt, “The Future of AIDS,” *Foreign Affairs*, Vol. 80, No. 6, November/December 2002, pp. 21–45; U.S. National Intelligence Council, *The Next Wave of HIV/AIDS: Nigeria, Ethiopia, Russia, India, and China*, Washington, D.C.: NTIS, September 2002, ICA 2002-042; David Murphy, “AIDS: A Nightmare in the Making,” *Far Eastern Economic Review*, August 15, 2002; UN Theme Group on HIV/AIDS in China, “HIV/AIDS: China's Titanic Peril,” June 2002, www.unaids.org/whatsnew/newadds/AIDSChina_2001update.pdf, accessed June 30, 2002; Joan Kaufman and Jun Jing, “China and AIDS—The Time to Act Is Now,” *Science*, Vol. 296, June 28, 2002, pp. 2339–2340; Elisabeth Rosenthal, “U.N. Publicly Chastises China for Inaction on HIV Epidemic,” *The New York Times*, June 28, 2002; K. Zhang and S. Ma, “Epidemiology of HIV in China,” *British Medical Journal*, Vol. 324, April 6, 2002, pp. 803–804; Bates Gill, Jennifer Chang, and Sarah Palmer, “China's HIV Crisis,” *Foreign Affairs*, Vol. 81, No. 2, March/April 2002, pp. 96–110; Joint United Nations Programme on HIV/AIDS (hereafter, UNAIDS), *AIDS Epidemic Update: December 2001*, www.unaids.org/worldaidsday/2001/Epiupdate2001/Epiupdate2001_en.pdf, accessed December 10, 2001; Marilyn Beach, “China Responds to Increasing HIV/AIDS Burden and Holds Landmark Meeting,” *The Lancet*, Vol. 358, November 24, 2001, p. 1792; Elisabeth Rosenthal, “AIDS Patients in China Lack Effective Treatment,” *The New York Times*, November 1, 2001, p. A1; Elisabeth Rosenthal, “China Asks U.S. Agency to Help

current status of the epidemic in China: Because the overwhelming majority of HIV cases in the country are undocumented and untreated, figures on the current prevalence (total cases) and incidence (new cases) of HIV among China's roughly 1.3 billion people rely heavily upon guesswork. In August 2001, Beijing health authorities announced that 600,000 Chinese were HIV-positive as of the year 2000. A little later, in July 2002, UNAIDS (i.e., the Joint United Nations Programme on HIV/AIDS) put the total number of people living with HIV/AIDS in China at 850,000—a figure with which Beijing, at the time, concurred. Just two months thereafter, in September 2002,

Combat H.I.V. Epidemic," *The New York Times*, August 31, 2001, p. A3; Bates Gill and Sarah Palmer, "The Coming AIDS Crisis in China," *The New York Times*, July 16, 2001, p. A15; Philip P. Pan, "Children's Lawsuits Force China to Confront AIDS," *Washington Post*, July 7, 2001, p. A1; John Pomfret, "Chinese City Is First to Enact Law on AIDS; Controversial Rule Set for Infected People, High-Risk Groups," *Washington Post*, January 15, 2001, p. A16; John Pomfret, "The High Cost of Selling Blood," *Washington Post*, January 11, 2001, p. A1; Abu Saleh M Abdullah, "Spread of HIV and AIDS in China," *The Lancet*, Vol. 356, November 25, 2000, p. 1856; Khabir Ahmad, "China Contemplates Criminalization of HIV Transmission," *The Lancet*, Vol. 356, November 11, 2000, p. 1666; Elisabeth Rosenthal, "In Rural China, a Steep Price of Poverty: Dying of AIDS," *The New York Times*, October 28, 2000, p. A1; "STD Rate Soars in China; Three in Four New Cases Are Among the Unmarried," *International Family Planning Perspectives*, Vol. 26, No. 3, September 2000, pp. 141–142; Elisabeth Rosenthal, "Scientists Warn of Inaction as AIDS Spreads in China," *The New York Times*, August 2, 2000, p. A1; Dennis Normile, "China Awakens to Fight Projected AIDS Crisis," *Science*, Vol. 288, June 30, 2000, pp. 2–3; UNAIDS, *China: Epidemiological Fact Sheet on HIV/AIDS and Sexually Transmitted Infections—2000 Update*, www.unaids.org/statistics/fact_sheets/pdfs/China_en.pdf, accessed July 10, 2000; AFP (Hong Kong), June 21, 2000, reprinted as "AFP: Prostitution, AIDS Said 'Rampant' in China," FBIS-CHI-2000-0621, June 21, 2000; Myron S. Cohen et al., "Sexually Transmitted Diseases in the People's Republic of China in Y2K: Back to the Future," *Sexually Transmitted Diseases*, Vol. 27, No. 3, March 2000, pp. 143–145; Y. Wang, "A Strategy of Clinical Tolerance for the Prevention of HIV and AIDS in China," *Journal of Medicine and Philosophy*, Vol. 25, No. 1, February 2000, pp. 48–61; AFP (Hong Kong), December 1, 1999, reprinted as "AFP: PRC Marks World AIDS Day with Condom Publicity Ban," FBIS-CHI-1999-1201, December 1, 1999; K. Zhang et al., "Changing Sexual Attitudes and Behavior in China: Implications for the Spread of HIV and Other Sexually Transmitted Diseases," *AIDS CARE*, Vol. 11, No. 5, October 1999, pp. 581–589; *Xinhua*, November 30, 1998, reprinted as "China: China Announces 12-Year Program of AIDS Control," FBIS-TEN-98-334, November 30, 1998; Richard Tomlinson, "China Recognizes AIDS Problem," *British Medical Journal*, Vol. 316, February 14, 1998, p. 493; Elena S. H. Yu et al., "HIV Infection in China, 1985 Through 1994," *American Journal of Public Health*, Vol. 86, No. 8, August 1996, pp. 1116–1122; and Qin Shulin et al., "First Case of Sexual Transmission of Human Immunodeficiency Virus in Mainland China," *Proceedings of the Chinese Academy of Medical Sciences and the Peking University Medical College*, Vol. 4, No. 4, December 1989, pp. 235–236.

the head of the Chinese Health Ministry's Department of Disease Control raised the official estimate to one million.

Other sources, however, suggest the total may be higher—perhaps far higher. (According to some claims, indeed, the province of Henan alone might already have 1.2 million or more HIV carriers.) A June 2002 report by the UN Theme Group on HIV/AIDS in China suggested that a reasonable estimate for China's 2001 HIV population was 800,000 to 1,500,000. The U.S. intelligence community, for its part, places China's year 2002 HIV-positive population at 1 million to 2 million. Nor is this the upper boundary of informed guesswork. In June 2002, an unnamed UN official told *The New York Times* that there certainly could be as many as 6 million HIV cases in China; if that surmise proved accurate, China might have the largest HIV population of any country in the world.

But whatever the true current rate of HIV prevalence in China may be, there is little doubt that totals are rising very, very swiftly. Chinese authorities and UNAIDS, for instance, both suggest that the prevalence of HIV in China has been increasing by about 20–30 percent per annum in recent years; the U.S. Centers for Disease Control and Prevention (CDC), for its part, cites estimates of a current “doubling time” of 30 months.

It is thought that HIV is currently transmitted in China by three main routes: (1) through extramarital heterosexual intercourse (abetted by the ongoing expansion of China's commercial sex business); (2) through illicit intravenous (IV) drug use; and (3) through the unsafe sale of blood (a procedure that can infect both recipients and vendors). To date, the Chinese HIV epidemic appears to be predominantly heterosexual in disposition, and the risk of HIV in China appears to be disproportionately high among the poor, the uneducated, and the rural. Current high-risk subpopulations are believed to include IV drug-users, persons selling (or using purchased) blood, and persons active in the commercial sex network. Larger at-risk groups may include the so-called “floating population” (the 100 million or more unauthorized migrants from rural regions seeking opportunity on the fringes of Chinese urban life) and the “unmarriageable males” (the rising numbers of young men in China who, due to the country's

growing youth gender imbalance, have no realistic prospect of securing a bride).²³

At this juncture, it seems very likely that China's HIV/AIDS problem will worsen considerably in the years ahead—in part because of choices made by Chinese policymakers, in part because of the limited options open to them.

To date, the Chinese government's response to its mounting HIV crisis has been piecemeal—but important components of that response have involved the segregation of HIV carriers, or the proposed criminal prosecution of HIV sufferers for the very activities that resulted in HIV infection. This draconian approach naturally encourages HIV carriers to avoid detection and to misrepresent their health status, thereby fueling further spread of the epidemic. Beijing has also attempted to suppress public discussion of the “tainted blood” problem, arresting activists working on the HIV commercial blood sales issue and shutting down their web sites. (Chinese authorities may be uneasy about the government's arguable complicity in fomenting this aspect of the national HIV problem.) From an epidemiological standpoint, of course, such strictures are at best utterly ineffective: for an epidemic cannot be censored.

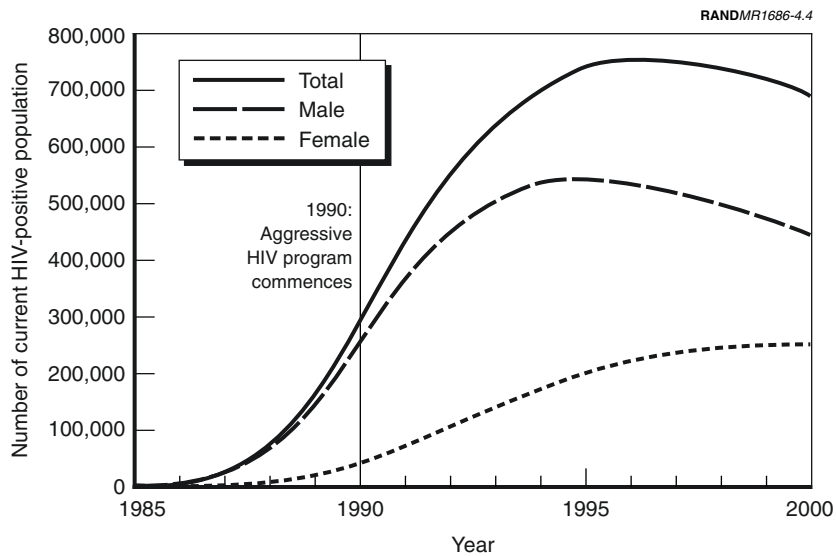
In contemporary Asia, perhaps the most successful HIV-control campaign thus far has been that of Thailand. Whether China could replicate a Thailand-style anti-AIDS policy is by no means clear. Analyses of the Thai program by the World Bank²⁴ and other groups have stressed the important role of “civil society” in the Thai strategy: Nongovernmental organizations assumed a major role in the prevention campaign, and popular trust in the government apparently lent credibility to the state's massive public education effort. A public health campaign premised upon the independence of nonstate actors and the population's confidence in its government could be rather more problematic for Beijing.

²³See “6.3 Brides for Seven Brothers,” *The Economist*, Vol. 349, December 19, 1998, pp. 56–58; Nicholas Eberstadt, *Prosperous Paupers and Other Population Problems*, New Brunswick, N.J.: Transaction Publishers, 2000, Chapter 10.

²⁴“Thailand's Response to AIDS: Building on Success, Confronting the Future,” *Thailand Social Monitor* (World Bank), No. V, November 2000, www.worldbank.or.th/cgi-bin/load?social/pdf/Thailand's%20Response%20AIDS.pdf, accessed January 28, 2002.

In any case, it is worth noting, Thailand's ostensibly exemplary AIDS campaign did not immediately check the spread of the epidemic. As Figure 4.4 underscores, by UNAIDS' reckoning, Thailand's HIV-positive population continued to increase for about a decade after the implementation of the country's aggressive anti-AIDS strategy, almost tripling over the interim.

China's response to its HIV crisis may also be circumscribed by economic considerations. Not the least of these concern the "net present value" of treatment for HIV carriers. For now, the most effective medical intervention for prolonging HIV patients' lives is the so-called Highly Active Anti-Retroviral Therapy (HAART, or "drug cocktail" regimen). The HAART regimen appears to extend the AIDS-free life expectancy of HIV patients by several years, thereby permitting



SOURCE: The Thai Working Group on HIV/AIDS Projection, *Projections for HIV/AIDS in Thailand: 2000–2020*, Bangkok, Thailand, February 2001.

Figure 4.4—Anatomy of a “Success”: Estimated HIV Prevalence in Thailand, 1985–2000

continued work for the economically active. The cost-benefit calculus of the HAART regimen, however, is quite unforgiving for low-income populations.

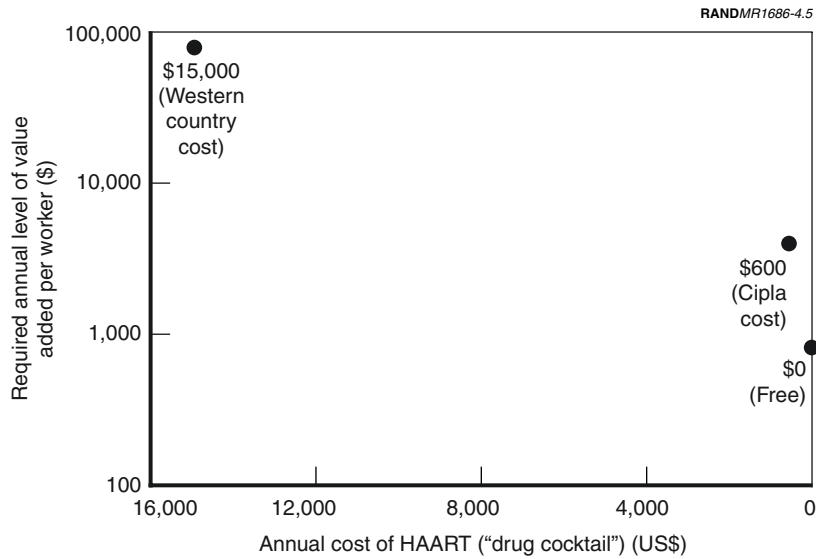
In the West, where proprietary medicines are used, the HAART treatment is very expensive—typically \$10,000 or more per patient per year. The generic versions of those medicines cost much less: In India, for example, the pharmaceutical manufacturer Cipla Ltd. currently markets a year's supply of HAART medications for about \$600. Yet as the illustrative calculations in Figure 4.5 attest, even at tremendously discounted prices, HAART would not necessarily prove to be an economic bargain for treating HIV-afflicted workers in low-income countries.

Under the arbitrary but not unreasonable assumptions outlined in Figure 4.5, the “social benefit” (through extended work life) of providing workers with generic HAART medications would only outweigh the “social cost” for laborers with an annual output of several thousand dollars a year. Even if HAART treatments could be obtained for free and dispensed only at the cost of the limited medical supervision entailed, workers generating much less than \$1,000 per annum would not be able to produce as much additional output for their society as their treatment would absorb in resource costs.²⁵

There are, to be sure, consequential differences in estimated output per worker in China, depending upon whether one relies upon exchange-rate-based comparisons or the alternative “purchasing-power-parity” (PPP) techniques.²⁶ Irrespective of the approach that

²⁵The situation may be even less promising than this analysis suggests. In order for the HAART therapy to be effective, the regimen must be followed quite closely, pursued in some instances literally on an hour-by-hour basis. It follows that implementing the regimen requires a sophisticated medical infrastructure—and very possibly, intensive utilization of its resources. Whether China's health care system could meet these challenges is a critical question—and the answer is not self-evidently “yes.” If the answer is in the affirmative, moreover, the question of health service costs then arises: If actual costs are substantially higher than we have hypothesized, the entire cost-benefit calculus shifts, and in a direction inauspicious for China's at-risk groups.

²⁶For a review of the issues and results, see Angus Maddison, *Chinese Economic Performance in the Long Run*, Paris: OECD, 1998; Alan Heston, “PPP Comparisons in the ESCAP Region: What Have We Learned?” paper prepared for symposium on Statistical Measurement of Economic Development of China and East Asian Region, Institute of



NOTES: Assumptions in calculations:

- Discount rate of 10 percent per year
- Average HAART treatment begins four years after HIV infection
- Life expectancy after onset of AIDS averages two years
- HAART treatment extends healthy life an average of three years
- Administering HAART requires \$150 per year in health care services
- Worker output fixed—unchanged by infection
- Worker ceases gainful employment with onset of AIDS.

Figure 4.5—Average Levels of Annual Worker Output Required to Pay for HAART Treatment: Illustrative Calculations

one ultimately deems appropriate for estimating output per worker in contemporary China, it will be apparent that a consequential pro-

International Studies, Meiji Gakuin University, Yokohama, Japan, November 19, 2000, www.meijigakuin.ac.jp/~iism/pdf/nonpo_003/Heston.pdf, accessed January 29, 2002; and Richard N. Cooper, "Chinese Economic and Budgetary Prospects," testimony before the U.S.-China Commission, December 7, 2001, www.uscc.gov/tescpr.htm, accessed January 30, 2002.

portion of the population at risk of contracting HIV/AIDS in China today would not qualify as candidates for HAART therapy on the basis of social cost-benefit calculations per se.

MODELING POSSIBLE TRAJECTORIES FOR AN HIV EPIDEMIC IN CHINA

Tremendous uncertainties attend the attempt to model the future of the HIV/AIDS epidemic. Public health specialists and epidemiologists have not yet developed robust techniques to permit them to predict the unfolding course of the epidemic with any degree of precision; in large measure, they still lack even the detailed epidemiological data that would allow them to explain convincingly the mechanisms of HIV transmission within ostensibly heterosexual low-income populations.

Those same uncertainties weigh heavily on any effort to project possible trajectories for the HIV/AIDS epidemic in China in the years ahead. Given those considerable constraints, we cannot presume to predict the future course of China's HIV/AIDS epidemic. We can, however, illustrate the likely demographic outcomes that would devolve from a range of explicitly specified and carefully described HIV scenarios, utilizing demographic and epidemiological modeling techniques.

What is important to keep in mind in this exercise is that the modeled assumptions drive the results. Table 4.3 lays out those assumptions and inputs for the reader.

In this exercise we relied upon the "SPECTRUM" demographic-epidemiological software package²⁷ and set as our Chinese demographic "baseline" the U.S. Census Bureau's 2000–2025 projections for China from its international database (October 2002 revisions).

²⁷Developed by The Futures Group International for the U.S. Agency for International Development, www.tfgi.com/spectrum.exe.

Table 4.3
China HIV/AIDS Epidemic Modeling Parameters

AIDS epidemic modeled with SPECTRUM software assuming

1. AIDS epidemic began in 1985 in China
2. Median AIDS incubation period of nine years
3. Life expectancy after AIDS of two years
4. Standard “heterosexual” distribution structure

Six initial scenarios

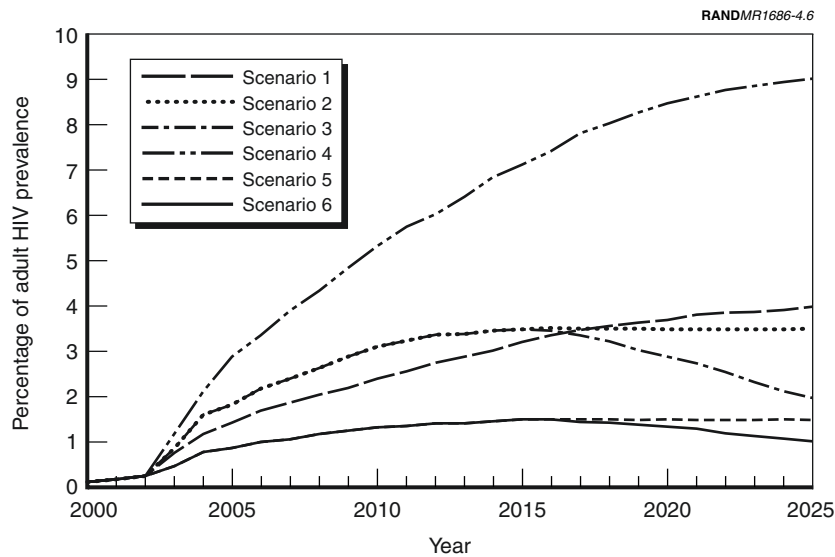
1. Order of magnitude increase
(Between 2000 and 2025, HIV prevalence rises from 0.14% to 4.0%)
2. Stabilized epidemic
(HIV prevalence rises by 2015 to 3.5% then holds steady until 2025)
3. Mitigated epidemic
(Same as scenario 2 up to 2015; thereafter, HIV prevalence declines by 2025 to 2.0%)
4. Really bad epidemic
(By 2025, 9.0% for China)
5. Mild epidemic
(HIV prevalence rises by 2015 to 1.5% then holds steady until 2025)
6. Very mild epidemic
(Same as scenario 5 up to 2015; thereafter, HIV prevalence declines by 2025 to 1.0%)

SOURCE: U.S. Census Bureau, *Baseline Age Structure, Fertility/Mortality/Migration Assumptions: U.S. Census Bureau International Database Projections, 2000–2025*.

In our scenarios, we modeled six hypothetical trajectories for the HIV/AIDS epidemic in China over the period 2000–2025. For midyear 2002, we assumed that the prevalence of HIV among China's “adult” population (ages 15–49) was 0.28 percent. (We were assuming a total HIV-positive population for China of just over 2 million.) We further assumed that the true HIV prevalence figure for 2000 was 1 million, or about 0.14 percent adult prevalence. These numbers are higher than the ones currently accepted by Beijing—but Beijing's preferred numbers may very well prove to be underestimates.

The prevalence curves for the six separate HIV scenarios (see Table 4.3) are traced out in Figure 4.6.

How realistic are the assumptions embodied in these six scenarios? One way of putting those hypothetical trajectories in perspective is to compare them with existing projections and existing estimates of HIV prevalence for other countries or regions.



SOURCES: See text.

Figure 4.6—China Prevalence Curves: Six Scenarios

Only one of our scenarios (i.e., “Really Bad Epidemic”) posits an eventual adult HIV prevalence rate as high as those in the so-called “Low Scenario” modeled by the U.S. Census to describe possible future HIV paths for urban Africa.²⁸ The 9 percent adult HIV prevalence rate that the “Really Bad Epidemic” ascribes to China in the year 2025 can be further compared against UNAIDS’ estimate of a sub-Saharan-wide prevalence rate of 8.8 percent for year-end 2002.

Of the five remaining scenarios only one (“Order of Magnitude Increase”) posits an eventual adult HIV prevalence rate as high as that estimated by UNAIDS for Cambodia as of year-end 1999 (i.e., 4 percent). And in two of the scenarios (“Mild Epidemic” and “Very Mild Epidemic”), the prevalence rates presumed for China’s HIV epidemic

²⁸U.S. Bureau of the Census, *World Population Profile: 1998*, Washington, D.C.: U.S. Census Bureau International Programs Center, 1999, Table B-1.

never reach the levels estimated to characterize contemporary Thailand (i.e., 2 percent).²⁹

Inescapably and necessarily, every one of these scenarios is speculative. The actual trajectory of China's HIV epidemic in the years ahead will be established by patterns and mechanisms of transmission, the prevalence of risky behaviors and practices among the general public, and the efficacy of the government's anti-AIDS strategies—quantities we cannot know today. From our present-day vantage point, however, each of these six scenarios can be seen to comport with HIV prevalence rates well within the contemporary historical experience of other societies (and in five of the six scenarios, within the historical experience of nearby East Asian societies). In that respect, none of these scenarios would appear to be *prima facie* implausible.

What would these various HIV trajectories suggest about the unfolding of the AIDS epidemic in China in the years immediately ahead? We may begin by considering the implications for the size of the total HIV-positive population (see Figure 4.7). Under our most "pessimistic" trajectory, China would have almost 80 million HIV carriers by the year 2025; under our most "optimistic" scenario, that number would "only" be about 11 million. Looking to the medium term—that is, to the year 2015—the "optimistic" trajectories posit a total HIV-positive Chinese population of about 14 million and the "pessimistic," a total of over 60 million, with the intermediate trajectories centering around 30 million.

The curves in Figure 4.7 are of course derived directly from the HIV prevalence scenarios from Figure 4.6. If the underlying assumptions guiding these scenarios are plausible, however, the numbers in Figure 4.7 suggest that China could soon have a far larger HIV-positive population than that found in any country in the world to date. *In fact, in four of the six scenarios in Figure 4.7, China's HIV population in the year 2015 would approach or exceed the entire estimated HIV population of sub-Saharan Africa today.*

²⁹Year-end 1999 adult HIV prevalence rates in the preceding paragraphs drawn from UNAIDS, *Report on the Global HIV/AIDS Epidemic: June 2000*, www.unaids.org/epidemic_update/report/Epi_report.pdf, accessed January 31, 2002.

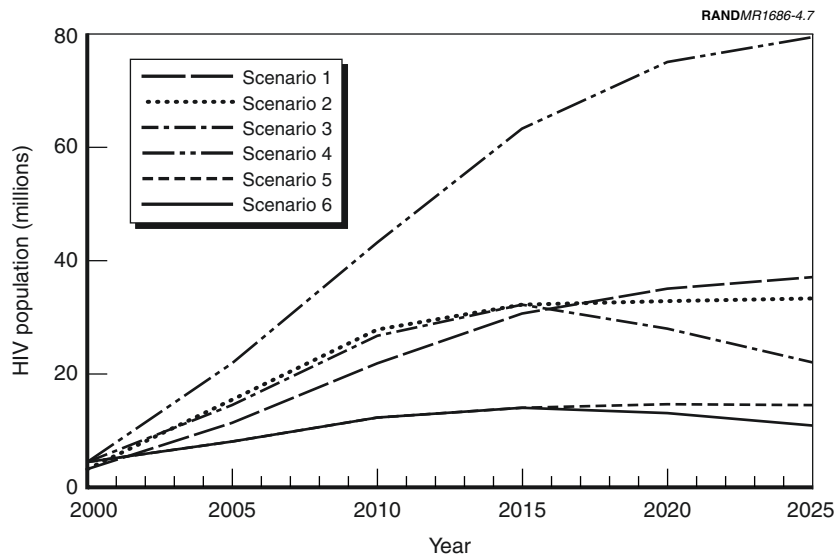


Figure 4.7—Projected HIV Population: China, 2000–2025

Until a cure for AIDS is discovered, HIV will continue to be invariably fatal. Table 4.4 charts the cumulative AIDS deaths implied for China under the six separate scenarios modeled above. Our model posits that China had only suffered about 20,000 AIDS deaths as of the year 2000 (quite possibly, a low estimate). But given the cruel arithmetic of the epidemic, those totals explode in every one of our scenarios.

By 2010, every one of our scenarios imputes a cumulative total of roughly 4 million or more AIDS deaths to China: The “pessimistic” trajectory implies about 12 million, and the intermediate trajectories are about 8 million. By the year 2015, our scenarios imply a cumulative total of 10–37 million AIDS deaths for China. Put another way, our China scenarios envision average AIDS deaths for the years 2010–2015 of 1.2 million per year on the low side and about 5 million a year on the high side. (To put those numbers in perspective, the U.S. Census Bureau estimates China’s total mortality in the year 2000 to be just under 9 million.)

Table 4.4
China's Cumulative AIDS Deaths
(in millions)

	2000	2005	2010	2015	2020	2025
Scenario 1	0.02	0.44	6.37	17.94	31.19	44.64
Scenario 2	0.02	0.46	8.07	22.89	37.04	48.27
Scenario 3	0.02	0.46	8.07	22.89	36.88	45.68
Scenario 4	0.02	0.51	11.90	37.24	67.00	96.81
Scenario 5	0.02	0.39	3.98	10.31	16.27	21.13
Scenario 6	0.02	0.39	3.98	10.31	16.23	20.46

By 2020–2025, under our most “pessimistic” HIV trajectory, China would be suffering almost 6 million AIDS deaths a year. By the arithmetic of the intermediate scenarios, annual AIDS deaths would total 2.2 million–2.6 million. Even under the “optimistic” trajectories, AIDS deaths would be mounting at a pace of over 800,000 per year. By 2025, cumulative AIDS mortality for China in every modeled scenario would exceed 20 million (or nearly the total number of deaths thought to have been experienced by all of humanity in the first two decades of the global HIV pandemic).

ECONOMIC IMPLICATIONS FOR CHINA OF HIV “BREAKOUT”

Under all of the scenarios modeled in the previous section, HIV in China would qualify as a humanitarian tragedy of unprecedented and devastating dimensions. But would such a tragedy have appreciable ramifications for China's economic performance?

The answer to the question may not be self-evident. Economies do not necessarily fare poorly during sudden, brutal bouts of mortality. During World War II, for example, the output levels of most of the major combatant powers increased significantly during the first years of hostilities, despite sharply increased death rates for persons of productive age.³⁰ More theoretically (and prosaically), the familiar

³⁰See, for example, Alan S. Milward, *War, Economy and Society, 1939–1945*, Berkeley, Calif.: University of California Press, 1977.

“Lewis two-sector model” of economic development would suggest that loss of low-productivity population from the “traditional” sector would impose only minimal losses on the overall economy—and it is precisely those segments of Chinese society that seem at disproportionate HIV risk at present.

To date, relatively little research has been devoted to the macroeconomic implications of HIV/AIDS—and most of that work has focused on the sub-Saharan region.³¹ The current state of economic thinking about this complex set of far-reaching interactions might fairly be described as introductory and exploratory. While this emerging literature has identified such issues as the potential effect of AIDS-increased mortality on population growth, labor supply, “dependency ratios,” and savings rates, many other possible factors bearing on long-run economic performance have not been seriously discussed.

In particular, two important potential economic ramifications of an HIV/AIDS epidemic in a low-income setting have as yet received little attention. First, by foreshortening adult life spans, a widespread HIV epidemic would seriously alter the calculus of investment in higher education and technical skills—thereby undermining the local process of investment in human capital. Second, widespread HIV prevalence could affect international decisions about direct investment, technical transfer, and managerial encampment in locales perceived to be of high health risk. In these fashions, HIV “breakout” could have far-reaching economic consequences—in effect, driving a wedge between the countries afflicted and the ongoing economic process of “globalization.” It is possible to imagine that the long-run economic impact of these HIV/AIDS effects could potentially be even more significant than the constraints the epidemic could impose on supplies of labor and/or local savings.

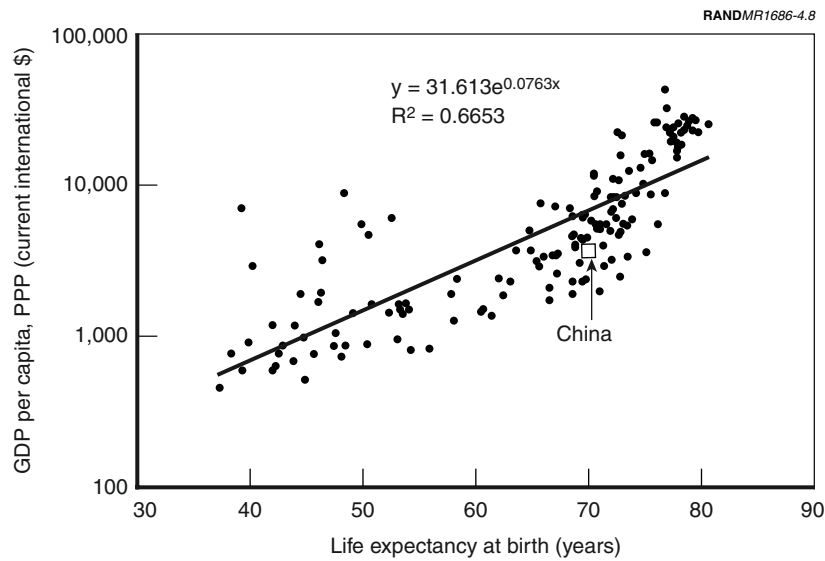
³¹For example, see David E. Bloom and Ajay S. Mahal, “Does the AIDS Epidemic Threaten Economic Growth,” *Journal of Econometrics*, Vol. 77, No. 1, March 1997, pp. 105–124; Channing Arndt and Jeffrey D. Lewis, “The Macro Implications of HIV/AIDS in South Africa: A Preliminary Assessment,” *South African Journal of Economics*, Vol. 68, No. 5, December 2000, pp. 856–887; Malcolm F. McPherson in association with Deborah A. Hoover and Donald R. Snodgrass, “The Impact on Economic Growth in Africa of Rising Costs and Labor Productivity Losses Associated with HIV/AIDS,” Cambridge, Mass.: John F. Kennedy School of Government, Harvard University, unpublished paper.

From a technical standpoint, a precise calculation of the prospective economic cost of HIV/AIDS for a given society would be an extraordinarily exacting task. In effect, it would require an accurate estimation of the net present value of the diminution in the current population's income stream and the net present value of the increase in its consumption of HIV-related goods and services. Such a project may be beyond our reach for some time to come.

On the other hand, one very simple but nonetheless instructive way of thinking about the possible economic implications of an HIV "breakout" in China would be in terms of a "health-based productivity model." In modern times, there has been a robust correspondence between health and productivity at the national level. This association holds both across nations at any given point in time, and also within particular countries over time. A simple regression plotting World Bank estimates of per-capita output (PPP-adjusted GDP per capita) against estimated life expectancy at birth for 155 countries for the year 1999, for example, captures two-thirds of the variance in the data set (see Figure 4.8). By the same token, a simple regression of life expectancy and per-capita output in China for the period since 1963 (i.e., since the end of the Great Leap famine) captures over 70 percent of the variance in that data set (see Figure 4.9). In both the "snapshot" international data set and the longitudinal Chinese data set, simple regressions suggest that a single year's increase in life expectancy at birth is associated with an increase in per-capita output of about 8 percent.

These simple regressions, of course, do not capture the complexity of the health-productivity relationship, nor do they indicate causal directions. On the one hand, wealth is an instrument that helps households and populations to afford the consumption and lifestyle patterns that are conducive to healthier life.³² On the other, improvements in health can boost productivity by extending potential work life, enhancing physical capacity, facilitating learning, and

³²See Lant Pritchett and Lawrence H. Summers, "Wealthier Is Healthier," *Journal of Human Resources*, Vol. 31, No. 4, Fall 1996, pp. 841–868.



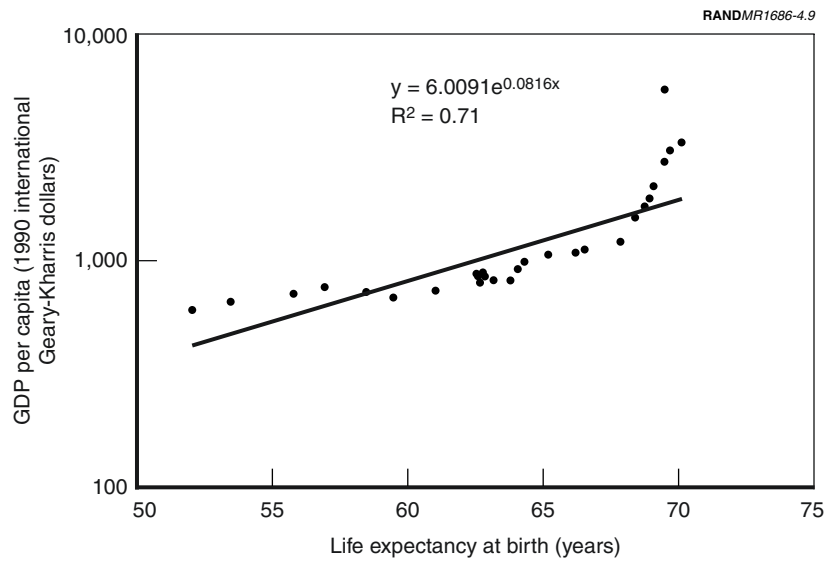
SOURCE: World Bank, 2000b.

Figure 4.8—GDP Per Capita for 155 Countries Versus Life Expectancy, 1999

contributing to “human capital deepening.”³³ Yet while the interactions between health and productivity are manifestly intricate and multidirectional, the brute fact is that for any country, at any point in time, life expectancy can be trusted as a fairly good predictor of per-capita output.³⁴ That being the case, what would the scenarios from

³³See Rati Ram and T. W. Schultz, “Life Span, Health, Savings and Productivity,” *Economic Development and Cultural Change*, Vol. 27, No. 3, April 1979, pp. 399–421; Robert William Fogel, “New Findings on Secular Trends in Nutrition and Mortality: Some Implications for Population Theory,” in Mark R. Rosenzweig and Oded Stark, eds., *Handbook of Population and Family Economics*, Volume 14, New York: Elsevier Sciences, 1997, pp. 433–481.

³⁴According to the data in Figure 4.8, China is currently an “underperformer” in health-based predictions of per-capita output: Actual per-capita output, to go by World Bank estimates, was about 45 percent lower than life expectancy numbers would have suggested, *ceteris paribus*. But of course all other things were *not* equal—



SOURCES: Sheng Luo, "Reconstruction of Life Tables and Age Distributions for the Population of China, by Year, from 1953 to 1982," New York: United Nations, World Population Prospects, 2000 revision; World Bank, 2000b; Angus Maddison, *The World Economy: A Millennial Perspective*, OECD, Paris, 2001, Table C3-c.

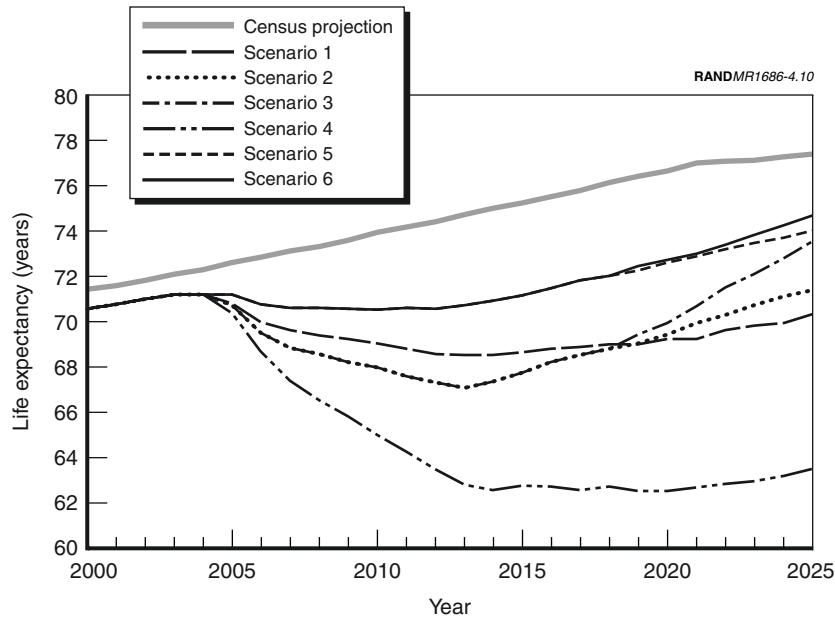
NOTES: Figures for 1963–1981 are from Luo and for 1982–1999 are from World Bank.

Figure 4.9—GDP Per Capita Versus Life Expectancy in China, 1963–1999

our China HIV models above augur for the country's prospective economic performance?

For "health-based productivity" predictions, we need to quantify HIV's impact on China's public health. Figure 4.10 does just that: It

and this is why China's relatively favorable endowment of human resources resulted in a relatively low level of output per capita in 1999. It should be no surprise to any observer to learn that contemporary China is an underperformer in this graphic. With a strengthening of the country's economic institutions (i.e., market order and rule of law), we would expect that China would move closer to the observed international association between health and output.



SOURCE: World Bank, 2001a; Luo, 2000 revision.

Figure 4.10—Projected Life Expectancy in China, 2000–2025

compares life expectancy at birth under the six HIV prevalence scenarios with our baseline projection for life expectancy in China over the 2000–2025 period (assuming that HIV/AIDS does not otherwise alter the endogenous improvements in life expectancy in China posited in the Census Bureau “baseline” projections). As we see, all of the HIV scenarios would alter China’s anticipated trajectory of health improvements over the coming generation.

In two of the six scenarios, life expectancy at birth in China would be lower in 2025 than it is today. Conversely, under the most “optimistic” of the scenarios, life expectancy in China in 2025 would be “only” three years lower than the baseline projection.

The situation is, in some ways, even starker for the year 2015. For that year, four of the six scenarios imply a life expectancy lower than in the year 2002; in the other two scenarios, life expectancy in 2015 would be barely higher than it was 15 years earlier. In 2015, indeed, life expectancy under these six scenarios would be between 4 and 12 years lower than the “baseline” Census Bureau series would have projected.

Health-based predictions of output provide a very rough quantitative indication of the economic consequences of the HIV epidemics envisioned in these scenarios. If we assume that one year of improved life expectancy continues to be associated with about an 8 percent increase in per-capita GDP in the years ahead, the HIV epidemics hypothesized in this chapter would cut China's long-run (2000–2025) growth rate per person 15–64 years of age by about 0.5–0.7 percent per year in the “optimistic” scenarios, by over 3.5 percent per year in the most “pessimistic” scenario, and by 1.5–2.5 percent in the intermediate scenarios. For the year 2015, corresponding calculations imply reductions in per-capita growth rates ranging from 1.5 percent per annum to over 5 percent per annum, with “intermediate” scenarios exceeding 2.5 percent per annum.³⁵

Clearly, all of those particular numbers are premised upon a number of major assumptions. The underlying point, however, is less open to contention: If health levels in China are severely affected by an HIV/AIDS epidemic and the country's health levels remain closely related to the country's economic potential, economic growth in China will suffer correspondingly. For these reasons, HIV/AIDS could indeed prove to be an exogenous factor—an independent “wild

³⁵We should note that the health-based-productivity approach offers what would be taken as very low estimates of prospective productivity growth for China. Using Census Bureau projections as a baseline, they would imply a per-capita increase of just 1.9 percent per annum for 2000–2025—a pace much slower than that anticipated by most informed observers today (including the authors of other chapters in this volume). What should be noted here is that our crude method here is offering something like an estimate of the “independent” influence of the health effect. If China were to move away from its “outlier” status on the graphic in Figure 4.8 and up to the international curve traced out there (through improvements in economic institutions, etc.), a substantial increase in per-capita output would result. “Economic reforms” and “institutional reforms” in China over the generation under consideration would thus be consonant with a more rapid pace of growth than the one implied by our simple method alone.

card”—in the Chinese economic development process over the decades immediately ahead.