

# **Rethinking Global Pharmaceutical Policy**

William Fisher and Talha Syed

## **Chapter 2: The Roles of Governments**

(version 8, October 2022)

Chapter 1 of this book examined the most prominent of the infectious diseases that are currently rampant in developing countries. A recurring theme was the need to generate new vaccines and medicines that would reduce the burdens caused by those diseases – and then to make high-quality versions of those vaccines and medicines accessible to the people who could benefit from them. How we might do so is the principal focus of chapters 3 through 7. The present chapter provides background for those chapters by describing the machinery currently used by governments, both in upper-income countries [UICs] and in low- and middle-income countries [LMICs], to manage the invention, manufacture, and distribution of pharmaceutical products.

Drugs differ from most products in several ways. First, they are unusually important. They are capable – sometimes uniquely capable – of preventing or curing potentially fatal or debilitating illnesses. Society thus has a larger stake in fostering their production than it does with respect to most goods and services. Next, they are unusually dangerous. The magnitude of their potential benefits is matched by the magnitude of their potential harms. Moreover, prediction of which drugs will be harmful and to whom is difficult. Typically, ordinary consumers are incapable of making such judgments. Finally, creating and testing new drugs is more expensive and risky than inventing most products. The hazard that they will be generated in suboptimal numbers is thus severe. These features, in combination, help explain why most governments in the world have long devoted more attention to drugs than to any other product.

You might expect that, in each country, a single government agency would conduct or coordinate the management of drugs. Remarkably, in no country is that true. Instead, the task is subdivided, and the separate dimensions are handled by different institutions. Most countries divide the job into three portfolios: the task of stimulating research and development; the task of ensuring that the drugs distributed to patients are safe and effective; and the task of ensuring that the people who need those drugs can get them. For simplicity, we will refer to these functions as the incentive function, the quality function, and the access function.

Section A, below, summarizes the ways in which each of these functions is currently handled by the governments of most UICs. For reasons that will become apparent, we will devote disproportionate attention to the United States, but will also take note of the modest respects in which the systems used in other developed countries differ. Section B considers how the same functions are currently handled in five representative LMICs: Malawi, Namibia, Cambodia, Thailand, and Bolivia.

## A. Upper-Income Countries

### 1. Incentives

Understanding the incentive function requires a brief foray into intellectual-property theory. This is well mapped territory, so we will traverse it quickly.

Economists have identified an important category of products that they refer to as “public goods.” Things of this sort have two related characteristics. First, they are nonrivalrous. In other words, they are not “used up” through consumption. As a result, an unlimited (or nearly unlimited) number of people can benefit from them. Second, they are “nonexcludable.” In other words, once they have been made available to one person, it is impossible (or very difficult) to prevent other people from gaining access to them without permission. Goods and services that have these linked features include navigational aids (such as lighthouses), transportation facilities (such as roads), national defense, and reproducible art.

Most public goods have large social benefits – because they can be enjoyed so widely. However, unless governments intervene in some way to promote them, public goods tend to be produced in inefficiently low quantities. The reason is that private parties considering producing them quickly realize that they will have difficulty charging people for access to them.<sup>1</sup> The classic illustration: a person or firm considering building a lighthouse to warn ships to avoid a dangerous reef soon realizes the impossibility of collecting a fee from all of the mariners who would benefit from the lighthouse – and so abandons the venture.<sup>2</sup>

The hazard that public goods will be underproduced is exacerbated by some circumstances and mitigated by others. Exacerbating circumstances include: high “up front” costs of creating the good in question; uncertainty concerning whether an effort to create it will succeed (which discourages risk-averse potential creators); and the ease with which embodiments of it may be replicated. Mitigating circumstances include: industry customs or lead-time advantages that enable the creators of public goods to recover some or all of their up-front costs; network externalities (which tend to raise barriers to entry and thus increase the ability of the producers of the good to recoup their costs); opportunities for increasing excludability through self-help strategies (such as secrecy or encryption); and non-pecuniary motivations for creating the good at issue (for example, fame,

---

<sup>1</sup> See Jeremy Bentham, *A Manual of Political Economy* (New York: G.P. Putnam, 1839); John Stuart Mill, *Principles of Political Economy* 5th ed. (London: Longmans, Green & Co., 1909), 932-33; A.C. Pigou, *The Economics of Welfare*, 2d ed. (London: Macmillan & Co., 1924); and J. G. Head, “Public Goods and Public Policy,” *Public Finance* 17 (1962): 197-221.

<sup>2</sup> Ronald Coase once argued (in contrarian fashion) that private parties had been able to construct lighthouses and operate them at a profit without state aid. See “The Lighthouse in Economics,” *Journal of Law and Economics* 17 (1974): 357-76. It turns out, however, that he misinterpreted the relevant history. See David E. Van Zandt, “The Lessons of the Lighthouse: ‘Government’ or ‘Private’ Provision of Goods,” *Journal of Legal Studies* 22 (1993): 47-72; and Steven Shavell, “The History of Lighthouses as Public Goods” (unpublished paper, February 1996).

reputation, academic tenure, scientists' pursuit of truth, or the pleasure of participating in collaborative creative communities).<sup>3</sup>

Against this backdrop, the reasons why governments must intervene to encourage the creation of new drugs should be apparent. Pharmaceutical innovations exhibit both characteristics that define public goods. Of course, the pills, capsules, or injections that embody those innovations are rivalrous and excludable; each can only be consumed by one patient. But the innovations themselves are both nonrivalrous and nonexcludable. The benefits arising out of a discovery of the medicinal benefits of a particular compound can be enjoyed by an unlimited number of persons, and once a drug containing that compound is provided to one patient, the discoverer will have great difficulty preventing competitors from replicating it – and thus will have trouble charging other patients for access to the discovery.

In addition, all of the circumstances that exacerbate the hazard of underproduction and few of the circumstances that mitigate it apply to pharmaceutical innovations. First, the probability that any given research project will succeed is both distressingly low and apparently diminishing. The magnitude of this probability is disputed, in part because it depends on how one measures the denominator. The most commonly cited and illuminating numbers are: For every 5000 compounds selected for screening, 250 show sufficient promise to be selected for preclinical testing, 5 are selected for clinical testing, and 1 is ultimately approved for distribution to the public. Some commentators contend that these numbers are misleading in one direction or another, but there is little doubt that the risk of failure is high – much higher than is true of innovations in consumer electronics or software, for example.

Next, the costs of generating new drugs are extraordinarily high – particularly when one takes into account (as one must) the costs of the many failures that precede approval and launch of a product. Again, exactly how high is disputed. Estimates range from \$200 million to \$4 billion per new molecular entity (NME).<sup>4</sup> Disagreement on this score is

---

<sup>3</sup> For examinations of the economics of particular public goods that emphasize one or another of these factors, see Yochai Benkler, "Coase's Penguin, or, Linux and the Nature of the Firm," *Yale L. J.* 112 (2002); *The Wealth of Networks: How Social Production Transforms Markets and Freedom* (New Haven: Yale University Press, 2006); Stephen Breyer, "The Uneasy Case for Copyright: A Study of Copyright in Books, Photocopies, and Computer Programs," *Harvard Law Review* 84 (1970); John M. Golden, "Biotechnology, Technology Policy, and Patentability: Natural Products and Invention in the American System," *Emory Law Journal* 50 (2001); Amy Kapczynski, "Order without Intellectual Property Law: Open Science in Influenza," *Cornell Law Review* 102 (2017); Arti K. Rai, "Regulating Scientific Research: Intellectual Property Rights and the Norms of Science," *Northwestern University Law Review* 94 (1999); Kal Raustiala and Chris Sprigman, "The Piracy Paradox Revisited," *Stanford Law Review* (2009); Ferrell 1995.

<sup>4</sup> Sharply differing estimates may be found in Olivier J. Wouters, Martin McKee, and Jeroen Luyten, "Estimated Research and Development Investment Needed to Bring a New Medicine to Market, 2009-2018," *JAMA Network Open* 323, no. 9 (2020); Joseph A. DiMasi, Henry G. Grabowski, and Ronald W. Hansen, "Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs," *Journal of Health Economics* 47 (2016). Patricia Danzon and Michael Furukawa, "Competition in Generic Pharmaceutical Markets: Cross-National Evidence," in *Petrie-Flom Drugs Conference* (2009); Rebecca S. Eisenberg, "The Role of the FDA in Innovation Policy," *Michigan Telecommunications & Technology Law Review* 13 (2007): 350; Christopher P. and Brantner Adams, Van V., "Estimating the Cost of New Drug Development: Is It Really \$802 Million?," *Health Affairs* 25, no. 2 (2006); F.M. Scherer, "The Pharmaceutical Industry -- Prices and Progress," *New*

intense. We cannot and need not resolve it here. It is sufficient for our purposes to acknowledge that the number is high – much higher than is true of any other kind of innovation.

Finally, the ease with which most pharmaceutical innovations can be deciphered and copied, and the low marginal costs of producing copies, increase the likelihood that innovators will be unable to recover their up-front costs.

For related reasons, few, if any, of the circumstances that mitigate the hazard of underproduction with respect to some public goods apply to pharmaceutical innovations. The lead time enjoyed by the creator of new drug is usually short. Increasing excludability through self-help is typically impracticable; pills can't be encrypted. And most potential innovators in the pharmaceutical field are relatively insensitive to non-pecuniary rewards.

There are some exceptions to these generalizations. For example, reverse engineering and replicating the new “biologics” is harder than it is for “small molecules”; vaccines (as we have seen) do exhibit network externalities; and some of the academic researchers who are key contributors to the chain of innovations that lead to new drugs are motivated by nonmonetary rewards. We will explore in subsequent chapters ways in which we might capitalize on each of these features. But it must be conceded at the outset that they pale in importance when compared to the conditions that threaten innovation.

There are five mechanisms that governments commonly employ to offset the risk that public goods will be produced in less-than-optimal quantities:<sup>5</sup>

- 1) Governments sometimes produce public goods themselves. Classic examples are lighthouses, roads, and national defense.
- 2) Governments often subsidize private parties who commit to producing public goods. The grants issued by many European governments to filmmakers (especially first-time filmmakers and those engaged in unconventional projects) are illustrative.
- 3) Governments sometimes promise to award prizes to successful producers of particular types of public goods. For example, the discovery of a method for measuring longitude was successfully incentivized in this way.
- 4) Governments can increase the financial returns available to the first producer of a public good by suppressing competition in the manufacture and sale of embodiments of that good. Copyright law is the premier example.
- 5) Finally, governments sometimes increase the “excludability” of public goods by penalizing activities that corrode self-help measures adopted by innovators. Examples include trade-secret law and criminal penalties for

---

*England Journal of Medicine* 351, no. 9 (2004): 928; Iain M. and Henderson Cockburn, Rebecca, "Scale and Scope in Drug Development: Unpacking the Advantage of Size in Pharmaceutical Research," *Journal of Health Economics* 20, no. 6 (2001).

<sup>5</sup> A more detailed exploration of these five options may be found in William W. Fisher, III, *Promises to Keep: Technology, Law, and the Future of Entertainment* (Stanford University Press, 2004), chapter 6.

trafficking in technologies that circumvent technological protection measures.

When trying to foster innovation with respect to pharmaceutical products, the government of the United States has traditionally relied primarily on a combination of the second and fourth of these strategies.

The principal manifestation of the second strategy consists of the grants issued by the National Institutes of Health (NIH) to private parties to support research on topics that can reveal opportunities for new pharmaceutical products. The NIH currently spends roughly \$34 billion per year on such “extramural” research (in addition to roughly \$4 billion on “intramural” research) – much more than any other nation.<sup>6</sup> More modest numbers of grants for health-related research are also issued by several other agencies of the federal government.<sup>7</sup> The large majority of the recipients of these grants are universities. Since 1980, they have been permitted to obtain patents on inventions generated by the funded research. The principal aspiration of this option is to give universities financial incentives to license the fruits of the projects to firms, who will use it to generate commercial products, thereby promoting “utilization of inventions arising from federally supported research.”<sup>8</sup>

A less obvious manifestation of the same general strategy consists of two provisions of the federal tax system designed to encourage private firms to engage in research and development. The first focuses on a specific form of medical research: the current version of the Orphan Drug Act enables companies to take a 25% tax credit on expenditures for human clinical testing of drugs aimed at rare diseases.<sup>9</sup> The second, the Research and Development Tax Credit, is not subject specific. Its ambition is to incentivize firms to engage in “incremental” research – i.e., to devote more resources than they typically would to research designed to improve the functional features of their products or services. The machinery that attempts to reach that elusive goal is sufficiently complex that many potentially eligible firms do not use it. Nevertheless, it is expensive; it results in a diminution of overall tax revenues of roughly \$12.6 billion per year.<sup>10</sup> Some portion of that money probably results in increased research on potential pharmaceutical products, but we don’t know how much.

More efficacious is another form of grant that often goes unnoticed: In several ways the federal government subsidizes the education of scientists, who, upon completing

---

<sup>6</sup> See National Institutes of Health, Budget, <https://www.nih.gov/about-nih/what-we-do/budget> (last visited August 24, 2021). A breakdown of the magnitudes of the grants that NIH devotes to each category of disease (as of June 25, 2021) is available at [https://report.nih.gov/categorical\\_spending.aspx](https://report.nih.gov/categorical_spending.aspx).

<sup>7</sup> The history of these ancillary sources of funding is traced in National Institutes of Health, “Federal Obligations for Health Research and Development by Federal Agency, 2002-2017, available at .

<sup>8</sup> 35 U.S.C. 200. The extent to which the availability of this option achieves its intended effect is hotly contested. For a thoughtful analysis of the competing positions, see Ian Ayres and Lisa Larrimore Ouellette, “A Market Test for Bayh-Dole Patents,” *Cornell Law Review* 102 (2017): 271-78.

<sup>9</sup> See Mirit Eyal-Cohen and Ana Santos Rutschman, “Tax Policy and Pharmaceutical Innovation,” *forthcoming* (2020): 23-26.

<sup>10</sup> See *ibid.*, 21-23.

their degrees and fellowships, either continue to do research in university laboratories or go to work for pharmaceutical firms.<sup>11</sup> In 2019, there were roughly 80,000 graduate students and 23,000 postgraduates working in the biomedical sciences in the United States. A majority of the latter and a substantial portion of the former received their primary form of financial support from federal grants.<sup>12</sup>

The feature that unites these various programs is that, in each, the government pays a private party – either directly or by reducing that party’s tax burden – in order to induce that party to engage in research that could improve human health.

Most of these grants are intended to stimulate “basic research:” investigations into the basic biological and chemical processes that sustain and govern life, investigations that typically have no direct commercial applications. But there are exceptions. One was noted above: the orphan-drug tax credit reimburses firms for some of the costs associated with clinical testing of promising drugs. Another exception is the huge sum of money that the federal government recently paid to pharmaceutical firms that were in the late stages of developing vaccines for COVID-19, in hopes of accelerating the refinement, testing, and

---

<sup>11</sup> Congressional Budget Office Report, p. 3.

<sup>12</sup> Source: NIH, “National Statistics on Graduates Students and Postgraduates,” <https://report.nih.gov/nihdatabook/category/21>.

production of those drugs. To date, \$19 billion has been disbursed for this purpose (not by the NIH, but by BARDA). The firms that received these funds are noted in the margin.<sup>13</sup>

This massive expenditure on applied research is highly unusual (and will probably be short lived). For the most part, the U.S. government has not used grants to stimulate late-stage research with respect to pharmaceutical products. Rather, it has relied on various forms of the fourth strategy discussed above: the suppression of competition in the manufacture and sale of innovative products.

The best known of the mechanisms it employs for this purpose is the patent system. In brief, the inventor of a new and nonobvious drug who promptly files a patent application that discloses enough information to enable other reasonably skilled scientists to replicate it is granted a patent that enables her to prevent competitors from making or selling identical or equivalent products for 20 years following the date of the patent application.

The duration of protection generated by such a patent is not as great as it might appear. An inventor (or, in the usual case, the company for whom she works) may – and typically does – file for patent protection soon after discovery of the potential medicinal

<sup>13</sup> Source: “Congressional Budget Office”, "Research and Development in the Pharmaceutical Industry," (2021), 11.

### Federal Funding to Support the Development of a COVID-19 Vaccine

BARDA Funding for COVID-19 Vaccines as of March 2, 2021										
Sponsor	BARDA Funding (Millions of dollars)	Funding for Research and Clinical Trials?	Funding for Manufacturing?	Funding to Purchase Vaccine?	Type of Vaccine	Date Entered Phase I Clinical Trials	Date Entered Phase II Clinical Trials	Date Entered Phase III Clinical Trials	Date Received EUA	Doses to be Purchased (Millions)
Pfizer and BioNTech	5,973	No	No	Yes	mRNA	4/29/20 <sup>a</sup>		7/27/20	12/11/20	300
Moderna and NIAID	5,896	Yes	Yes	Yes	mRNA	3/16/20	5/29/20	7/27/20	12/18/20	300
Sanofi Pasteur and GlaxoSmithKline	2,073	Yes	Yes	Yes <sup>b</sup>	Spike Protein	9/3/20 <sup>a</sup>		*	*	100
Johnson & Johnson (Janssen subsidiary)	1,998	Yes	Yes	Yes	Viral Vector	7/15/20 <sup>a</sup>		9/7/20	2/27/21	100
Novavax	1,600	No	Yes	Yes <sup>b</sup>	Protein Subunit	5/25/20 <sup>a</sup>		12/22/20 <sup>c</sup>	*	100
AstraZeneca and Oxford University	1,600	Yes	Yes	Yes <sup>b</sup>	Viral Vector	4/23/20 <sup>a</sup>		8/28/20 <sup>d</sup>	*	300
Merck and IAVI	143	Yes	Yes <sup>e</sup>	No	Viral Vector	8/27/20 <sup>a</sup>		Discontinued	1/25/21	

Data source: Congressional Budget Office, using data from the Department of Health and Human Services. See [www.cbo.gov/publication/57025#data](http://www.cbo.gov/publication/57025#data).

BARDA = Biomedical Advanced Research and Development Authority; EUA = emergency use authorization; IAVI = International AIDS Vaccine Initiative; mRNA = messenger ribonucleic acid; NIAID = National Institute of Allergy and Infectious Diseases; \* = The vaccine has not yet reached this stage.

- a. Phase I and phase II clinical trials combined.
- b. Contingent upon receiving emergency use authorization.
- c. Phase III trials with South African participants began on August 17, 2020; trials with U.K. participants began on September 28, 2020.
- d. Phase III trials with U.K. participants began on June 2, 2020.
- e. Funding to manufacture the Johnson & Johnson vaccine.

use of the compound at issue.<sup>14</sup> The company must then devote several years to preclinical research and clinical trials, and then await the approval of the product by the Food & Drug Administration (more on this shortly). The resultant reduction of the effective duration of market exclusivity is partly offset by provisions of the Hatch-Waxman Act, which enable the patentee to obtain up to 5 years of extension of the patent term for half of the period devoted to clinical trials and all of the period consumed by the FDA approval process. But even after these adjustments, the patent is likely to expire roughly 12 years after the drug is first marketed. In rare cases, such patents expire even before the products are launched.

In theory, innovators are able to supplement the patents they obtain on new products (so-called “composition of matter” patents) with patents on particular *uses* of those drugs. If the innovators discover new medicinal uses of their creations after they first apply for product patents, they can obtain so-called “new-use” patents that could extend substantially their terms of protection. In practice, however, the difficulty of enforcing such patents sharply limits their value.<sup>15</sup>

Much more important than new-use patents are the protections against competition that innovators are now able to obtain, not through the patent system, but through so-called “exclusivity” rules, which forbid the FDA to approve, for prescribed periods of time, drugs that would compete with pioneers. Such rules come in various shapes and sizes: 7 years of market exclusivity<sup>16</sup> for “orphan drugs” (drugs that address diseases that affect fewer than 200,000 patients in the United States); 5 years of data exclusivity for new chemical entities (NCEs); 3 years of data exclusivity for modifications of existing drugs significant enough to require new clinical trials; an additional 6 months of market exclusivity for on-patent drugs that have been tested (at the FDA’s request) for efficacy on children;<sup>17</sup> an additional 5 years of market exclusivity for new antibiotic agents; and, last but not least, 4 years of data exclusivity plus an additional 8 years of market exclusivity for biologics.<sup>18</sup>

Sometimes, these various legal regimes are redundant. For example, the five-year data-exclusivity protection for a pioneering small molecule that enjoys twelve years of useful patent protection is largely superfluous. But in two contexts, data exclusivity is

---

<sup>14</sup> The permissibility of filing for a patent at this early stage was firmly established by *In re Brana*, 51 F.3d 1560 (Fed. Cir. 1995).

<sup>15</sup> See Eisenberg, “The Role of the Fda in Innovation Policy.”

<sup>16</sup> The terms “data exclusivity” and “market exclusivity” are protean, but roughly speaking the difference between them is that data-exclusivity rules forbid the FDA to accept an application that relies upon safety or efficacy studies conducted by the beneficiary of the exclusivity, whereas market-exclusivity rules forbid the FDA to approve a drug that will compete with a drug developed by the beneficiary of the exclusivity. In most circumstances, rules of the two types give rise to comparable levels of protection, because the cost of conducting the clinical trials necessary to produce and then submit to the FDA a new body of data concerning safety and efficacy is prohibitive.

<sup>17</sup> See GAO, *Pediatric Drug Research: Studies Conducted under Best Pharmaceuticals for Children Act* (2007), available at <http://www.gao.gov/assets/260/257925.pdf>. This 6-month extension is commonly referred to as “pediatric exclusivity.” For an assessment of its economic value, see Jennifer S. Li, “Economic Return of Clinical Trials Performed Under the Pediatric Exclusivity Program,” *JAMA* 297, No. 5 (1997).

<sup>18</sup> See Letter to FDA Commissioner Hamburg from several generic manufacturers, January 20, 2011, available at <http://www.hpm.com/pdf/generics%20biosimilars%20letter.pdf>.



valuable: when the NCE is insufficiently new to be patentable and when the development and testing of the drug has absorbed most of the patent term. In addition, data exclusivity has an important advantage in terms of ease of enforcement; the ability to bring a patent-infringement suit is a less reliable and more expensive source of protection than a denial of FDA approval to a competitor.

In combination, patent protection and data exclusivity are highly effective in suppressing competition for the large majority of new drugs for roughly a decade. Illuminating data concerning the impediments that these rules create to generic entry and the resultant ability of innovators to maintain high prices has been gathered and analyzed by Frank Lichtenberg and Gautier Duflos.<sup>19</sup> Relying on a data set encompassing “virtually all prescription drugs sold during the period 2000-2004 in the United States,” they show that:

- mean generic market share remains low until 12 years after a pioneer first enters a market, then increases sharply;
- prices for drugs rise gradually between entry and year 12, then begin to decline;
- advertising expenditures by the innovator rise sharply between entry and year 12, then decline; and
- the total number of prescriptions (pioneer + generics) remains relatively constant between year 12 and year 16 despite the diminution in price. (The principal explanation for this last effect seems to be the reduction in advertising and the distribution of promotional free samples by the pioneer following expiration of the patent.)

Although this data is old, the relevant portions of the legal regimes have not changed significantly.

The substantial period of time in which, on average, pharmaceutical firms are shielded against competition (and thus able to charge high prices) enables them to earn generous profits – some of which they then reinvest in research designed to generate new drugs. How much? We don’t know for sure, because much of the relevant data is not publicly available, but here are some rough numbers: The Congressional Budget Office recently estimated that, “On average, pharmaceutical companies spent about one-quarter of their revenues (net of expenses and buyer rebates) on R&D expenses in 2019, which is

---

<sup>19</sup> See Frank R. Lichtenberg and Gautier Duflos, “The Effect of Patent Expiration on U.S. Drug Prices, Marketing, and Utilization by the Public,” *Manhattan Institute for Policy Research* (2009), [http://www.manhattan-institute.org/html/mpr\\_11.htm](http://www.manhattan-institute.org/html/mpr_11.htm). Other studies generating results that are roughly consistent with these findings include: Ernst R. Berndt and Joseph P. Newhouse, “Pricing and Reimbursement in U.S. Pharmaceutical Markets,” in *Oxford Handbook on the Economics of the Pharmaceutical Industry*, ed. Patricia M. Danzon and Sean Nicholson (Oxford University Press, 2012); Danzon and Furukawa, “Competition in Generic Pharmaceutical Markets: Cross-National Evidence.”; Maxwell R. Morgan, “Regulation of Innovation under Follow-on Biologics Legislation: Fda Exclusivity as an Efficient Incentive Mechanism,” *Columbia Science and Technology Law Review* 11 (2010); Scherer, “The Pharmaceutical Industry -- Prices and Progress.”

almost twice as large a share of revenues as they spent in 2000.”<sup>20</sup> The total amount of such spending is large: the members of PhRMA (major pharmaceutical firms with operations in the United States) spent (throughout the world) about \$83 billion on research and development during 2019.<sup>21</sup> Because this figure does not include spending on research by small biotech firms, the total amount spent by private companies is significantly higher.<sup>22</sup>

Analogous incentives can be found elsewhere in the world. All other high-income countries have patent laws that are similar (in pertinent respects) to US patent law, and most have roughly similar data-exclusivity rules.<sup>23</sup> In addition, the governments of most of the high-income countries subsidize research in much the same way that the NIH does in the US.

To be sure, in no other country are total expenditures on research and development as high as they are in the United States. (The disproportionate role currently played by the United States in pharmaceutical research is the principal reason why we are devoting some much attention to the machinery in place there.) However, in terms of the *percentage* of its gross domestic product that each country spends on health-related GDP, the United States has traditionally been less of an outlier. Indeed, the percentages in Switzerland and Denmark may be higher.<sup>24</sup>

## 2. Quality

As Daniel Carpenter has shown, the government of the United States regulates drugs more extensively and aggressively than any other product.<sup>25</sup> The most obvious manifestation of this aggressiveness is the system of “comprehensive licensure”: new pharmaceutical products may not be distributed in the United States unless and until they have been approved by the Food and Drug Administration (FDA).

How does the FDA decide which drugs to approve? You might assume that it would do so by weighing the risks and benefits of each candidate. A simple version of this

---

<sup>20</sup> See Office”, “R&D in the Pharmaceutical Industry.”

<sup>21</sup> See *ibid.*, 1-2.

<sup>22</sup> Several years ago, Michael Scherer showed that the percentage reinvested each year varies with the prices of drugs. See F.M. Scherer, “The Economics of Parallel Trade in Pharmaceutical Products,” (2001), [http://www.wto.org/english/tratop\\_e/trips\\_e/hosbjor\\_presentations\\_e/13scherer\\_e.doc](http://www.wto.org/english/tratop_e/trips_e/hosbjor_presentations_e/13scherer_e.doc); “The Pharmaceutical Industry -- Prices and Progress,” 929. That correlation likely has not changed.

<sup>23</sup> For a summary of the modestly different data exclusivity rules in the European Union, see \_\_\_\_.

<sup>24</sup> See John-Arne Rottingen et al., “Mapping of Available Health Research and Development Data: What’s There, What’s Missing, and What Role Is There for a Global Observatory,” *Lancet* 382 (2013): 1301. The illuminating comparisons in the article are outdated. However, with the important exception of increasing spending by China, the relative positions of the major developing countries seem not to have changed materially. On the rapid rise of spending on pharmaceutical R&D in China in recent years, see Lan Qiu et al., “Public Funding and Private Investment for R&D: A Survey in China’s Pharmaceutical Industry,” *Health Research Policy and Systems* 12, no. 27 (2014).

<sup>25</sup> Daniel Carpenter, *Reputation and Power: Organizational Image and Pharmaceutical Regulation at the Fda* (Princeton: Princeton University Press, 2010).

approach would compare (a) the health benefits that could be reaped through distribution and use of the candidate drug with (b) the concomitant potential for harm. To calculate (a), the agency would measure (or demand evidence of) the advantages of the candidate drug over existing drugs and the number of people who would benefit thereby. To calculate (b), the agency would measure (or demand evidence of) the severity of the increased risk of side-effects, injury, or other adverse events posed by distribution and consumption of the candidate. The agency would then approve the drug if and only if (a) exceeded (b). Refinements of these calculations can readily be imagined: use of various discount rates to compare present benefits and harms to future benefits and harms; limitations on the populations who are granted access to the drug (specifically, limitations that could reduce (b) more than (a) and thus improve the ratio of benefits to harms); adjustments to the methods by which both figures are calculated in order to give greater weight to aggregate benefits reaped through generating large improvements in (or threats to) the health of a few people than to aggregate benefits reaped through generating slight improvements in (or threats to) the health of many people;<sup>26</sup> and so forth. But putting such possible refinements aside, the basic approach seems clear enough: drugs should be approved if and only if their distribution would generate net improvements in human health.

Current practice in the US, unfortunately, falls short of such an approach. The primary reason is that the authority of the FDA has been defined, not by a single, comprehensive statute, but by a series of amendments, each provoked by – and thus designed to prevent recurrence of – a particular crisis. The principal provocations and associated legislative responses are summarized in the chart on the following page.<sup>27</sup>

---

<sup>26</sup> Reasons why we might wish to make such adjustments are considered in Chapter 5.

<sup>27</sup> For much more extensive analyses of this history, see Carpenter, *Reputation and Power*; Krista Hessler Carver, Jeffrey Elikan, and Erika Lietzan, "An Unofficial Legislative History of the Biologics Price Competition and Innovation Act of 2009," *Food and Drug Law Journal* 65 (2010); Anna B. Laakmann, "Collapsing the Distinction between Experimentation and Treatment in the Regulation of New Drugs," *Alabama Law Review* 62 (2011); Richard A. Merrill, "The Architecture of Government Regulation of Medical Products," *Virginia Law Review* 82 (1996).

Table 1

<b>Crisis</b>	<b>Response</b>	<b>Main Features</b>
Deaths of children from contaminated smallpox and diphtheria vaccines	Biologics Act of 1902	Biologics may only be manufactured in federally licensed facilities
Rash of dangerous “patent medicines”	1906 Food and Drug Act	Bureau of Chemistry (predecessor of FDA) empowered to initiate punishment of manufacturers of adulterated or misbranded drugs
Narrow interpretation of the 1906 Act in <i>Johnson</i> (1911)	1912 Sherley Amendment	“Misbranding” includes making knowingly false statements about therapeutic benefits
Elixir sulfanilimide disaster	1938 Food, Drug and Cosmetic Act	Manufacturers must notify FDA 180 days prior to release; “misbranded” includes “false or misleading in any particular”; duty to disclose adverse evidence
Thalidomide disaster	1962 Kefauver-Harris Amendments	Comprehensive licensure system; agency assesses “effectiveness” as well as safety; FDA interprets “substantial evidence” as requiring two multi-stage randomized controlled trials (RCTs)
Increasingly costly delays in drug approval process	1992 Prescription Drug User Fee Act (PDUFA)	FDA given more resources to accelerate review process
AIDS crisis	1997 Food and Drug Modernization Act (FDAMA)	Codify “fast-track program,” including truncated review for promising drugs addressing “life-threatening illnesses”
Increasing uncertainty caused by dual paths for drug approvals	2009 Biologics Price Competition and Innovation Act (BPCIA)	Clarified standards for the evaluation and approval of “biosimilars”

The system generated through this process has important strengths: It’s fast; partly because of the PDUFA adjustments, the large majority of applications are now processed in less than 10 months. It does a reasonably good job of preventing unnecessary injuries

by keeping dangerous products off the market – a far better job than is achieved through the less prophylactic regulatory and liability systems that govern most other products. And it at least attempts to deal expeditiously with especially grave illnesses and especially promising responses thereto.

To be sure, even in these respects, the system is not perfect. For example, its speed may have a cost; debate continues concerning whether the fast pace results in a larger number of adverse events.<sup>28</sup> The FDA probably refuses to approve more drugs than it should – because “type 1 errors” (approving unsafe drugs) are so much more visible than “type 2 errors” (disapproving safe drugs).<sup>29</sup> And the agency currently responds less nimbly to urgent health needs or pharmaceutical breakthroughs than the FDAMA sponsors hoped.

But more important (for our purposes, at least) than these imperfections are some fundamental limitations:

- The system measures efficacy by comparing candidates to placebos, rather than to already existing drugs.
- The system fails to compare benefits and harms systematically. Although since 1938, the agency has engaged in some such comparisons under the rubric of assessing “safety,” it still does not engage in formal risk-benefit assessment.<sup>30</sup>
- It contains no mechanism for *delaying* the introduction of new drugs when future generations would benefit from less rapid exhaustion of a limited set of potential therapies. (As Kevin Outterson has shown, this defect might have especially unfortunate consequences with respect to antibiotics.<sup>31</sup>)
- The agency adheres to the standard sequence of animal trials, followed by three stages of clinical trials, even when that sequence is inappropriate. (For example, as Steven Hyman has shown, animal trials for drugs designed to address neuropsychiatric disorders have never provided useful evidence concerning which of those drugs would prove effective in humans. Thus, use of such trials likely screens out some potentially valuable drugs, but provides us no aid in excluding ineffective drugs.)
- The agency devotes most of its resources assessing drugs prior to approval. It rarely withdraws approved drugs from the market and has no systematic

---

<sup>28</sup> See, e.g., Mary K. Olson, "First Drug Launches in the U.S. And Drug Safety," in *Petrie-Flom Drugs Conference* (2009).

<sup>29</sup> Henry Grabowski and John M. Vernon, *The Regulation of Pharmaceuticals: Balancing the Benefits and Risks* (1983), 10.

<sup>30</sup> See Merrill, "The Architecture of Government Regulation of Medical Products," 1764.

<sup>31</sup> See Kevin Outterson, "The Legal Ecology of Resistance: The Role of Antibiotic Resistance in Pharmaceutical Innovation," *Cardozo Law Review* 31 (2010).

way of gathering evidence concerning how drugs, once approved, are performing on ordinary patients.<sup>32</sup>

- The agency tolerates so-called “off label” uses of drugs – but fails to provide physicians or patients useful information concerning safety and efficacy in those contexts.

The defects are not hard to explain; they are byproducts of the political process through which this regulatory system emerged. It should not be surprising that the system contains features that would prevent recurrence of the particular crises that triggered legislative responses but omits features that would enable a more sensitive and comprehensive assessment of the likely net impact on public health of drug candidates. That explanation, if accurate, is discouraging, because it suggests that comprehensive reform of this system is unlikely in the foreseeable future.

Again, this system finds parallels in other upper-income countries. In all, drugs must be approved by at least one government agency before they can be distributed. The criteria used to approve and disapprove drugs differ modestly from those in the United States. For example, the European Medicines Agency, which since 1995 has had primary responsibility for evaluating drugs in the European Union (and some countries outside the Union), is somewhat slower than the FDA (in part because other government agencies in the participating countries are also involved in marketing approvals). According to officials in both, the EMA is more risk averse, at least with respect to cancer drugs.<sup>33</sup> In addition, the way in which the EMA assesses biosimilars and processes post-approval reports from patients are somewhat different. But none of these points of difference is drastic; the large majority of drugs submitted for approval are handled similarly by the two agencies.<sup>34</sup>

The regulatory agencies in upper-income countries have come to be known as “stringent regulatory authorities” [SRAs], for obvious reasons.<sup>35</sup> Collaboration among them was enhanced by the establishment in 1990 of the International Conference on the Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human

---

<sup>32</sup> See Laakmann, "Collapsing the Distinction between Experimentation and Treatment in the Regulation of New Drugs."

<sup>33</sup> See G. Tafuri et al., "How Do the Ema and Fda Decide Which Anticancer Drugs Make It to the Market? A Comparative Qualitative Study on Decision Makers' Views," *Annals of Oncology* 25 (2014).

<sup>34</sup> For comparisons of the FDA and the EMA, see, e.g., Lynn J. Howie, Bradford R. Hirsh, and Amy Abernathy, "A Comparison of Fda and Ema Drug Approval: Implications for Drug Development and Cost of Care," *Oncology* 27, no. 12 (2013), [https://www.cancernetwork.com/oncology-journal/comparison-fda-and-ema-drug-approval-implications-drug-development-and-cost-care](https://www.cancernetwork.com/oncology-journal/comparison-fda-and-ema-drug-approval-implications-drug-development-and-cost-care;); Slobodan M. Jankovic, "Comparison of Ema and Fda Guidelines for Drug Interactions: An Overview," *Clinical Research and Regulatory Affairs* 31, no. 2-4 (2014); Anthony J. Hattwell et al., "Regulatory Approval of Pharmaceuticals without a Randomised Controlled Study: Analysis of Ema and Fda Approvals, 1999–2014," *BMJ Open* 6 (2016); Mwango Kashoki et al., "A Comparison of Ema and Fda Decisions for New Drug Marketing Applications 2014–2016: Concordance, Discordance, and Why," *Clinical Pharmacology & Therapeutics* 107, no. 1 (2020).

<sup>35</sup> A list of the authorities that the WHO considers “stringent” is available at <https://www.who.int/initiatives/who-listed-authority-reg-authorities/SRAs>.

Use [ICH]. Founded by the European Community, Japan, and the United States, the ICH has since expanded to include several other UICs.<sup>36</sup> Among its fruits is a “Common Technical Document” [CTD], which provides a standardized format for applications for marketing approval and thus reduces the costs of gaining access to multiple markets.<sup>37</sup>

### 3. Access

The third way in which governments seek to manage pharmaceutical products is to increase the likelihood that the people who could benefit from them receive them. Three main strategies for achieving that objective have been identified and tried.

The first is “procurement.” Governments sometimes identify drugs from which their residents could benefit, purchase large quantities of those drugs from the private firms that produce them, and then distribute them – at low cost or for free – to consumers, either directly or, more commonly, through intermediaries. The larger the percentage of potential consumers served in this way, the more closely the government approximates a monopsonist – and thus, other things being equal, the lower the price that the government is likely to pay per dose. (Whether that effect should be considered an advantage or a disadvantage depends on factors we will address shortly.)

This system is used infrequently by most developed countries. In the United States, for example, until recently the only major procurement program was the Vaccines for Children Program, under which the federal government (specifically, the Centers for Disease Control) purchases directly from private manufacturers vaccines for most common childhood diseases (diphtheria, haemophilus influenza type b, hepatitis A and B, measles, mumps, pertussis, pneumococcal disease, polio, rubella, tetanus, and chickenpox), and then distributes them to persons under the age of 18.<sup>38</sup> Roughly half of the childhood population in the United States is currently vaccinated under this program. The success of the program helps to explain the dramatic decrease in the incidence of these diseases in the United States chronicled in the Introduction to this book (although progress along this dimension is threatened by growing popular resistance to vaccination).

The extreme threat to public health posed by the coronavirus pandemic has prompted the US government to expand its reliance on this general approach. As indicated above, the federal government purchased large quantities of COVID-19 vaccines and then used various distribution systems to make them available for free or for modest prices to all US residents (or at least all residents willing to take them).<sup>39</sup> However, once the coronavirus crisis has subsided, the US is likely to return to its longstanding policy of relying rarely on procurement to ensure access to medicines.

---

<sup>36</sup> For the current lists of members and observers, see <https://www.ich.org/page/members-observers>.

<sup>37</sup> See <https://www.ich.org/page/ctd>.

<sup>38</sup> See John E. Calfee and Scott Gottlieb, "Putting Markets to Work in Vaccine Manufacturing," *American Enterprise Institute for Public Policy Research* (2004).

<sup>39</sup> See Sarah Kiff, "The U.S. Commits to Buying Millions of Vaccine Doses. Why That's Unusual," *New York Times*, July 22, 2020.

In middle-tier countries, procurement is used somewhat more often. The premier example of this approach is China's "Zero Markup Policy for Essential Drugs" (ZPED), adopted in 2009 as part of the National Essential Medicine Policy. The relevant aspect of the ZPED system is a mechanism by which provincial governments purchase essential medicines and then distribute them to "primary healthcare facilities." The system has not yet achieved all of its goals, but it appears to have contributed to a substantial recent decline in the prices paid by most residents of China for crucial drugs (as well as a reduction in the incidence of over-prescription of medicines).<sup>40</sup>

The second of the three strategies is price regulation. By capping the prices that consumers must pay, governments can increase the number of consumers able to purchase the drugs they need. Most developed countries rely heavily on this approach.<sup>41</sup> The United States is an exception. For the most part, the US government currently lets the market set the price for drugs. Indeed, the government works actively to prevent the price-regulation systems employed in other countries from influencing the market in United States. The primary mechanism it employs for this purpose is an overlapping set of rules that block the importation of drugs into the US, even if they were originally manufactured in this country. Such rules are commonly justified on safety grounds: they are said to shield American consumers against contaminated or counterfeit products. But their principal function is to protect manufacturers against arbitrage – and the resultant downward pressure on the prices they charge in the United States. (In Chapter 4, we will examine in detail the differential pricing practices enabled by these rules.) Some of the legislative proposals currently on the table in the United States would introduce, for the first time, comprehensive price regulation of the sort common in continental Europe and Japan, but the prospects for the adoption of such initiatives in the near term are not good.

The last of the strategies is insurance. The ability of consumers to purchase the drugs they need may be enhanced by reimbursing them for some or all of the cost of those purchases. This is the approach upon which the United States currently relies most heavily. In two ways, the US government works to reduce the portion of the prices of drugs that consumers must pay. First and most obviously, it funds programs (Medicaid and Medicare) that wholly or partially cover the costs of prescription drugs for major portions of the American population.<sup>42</sup> Second, it subsidizes private medical insurance by exempting employment-based health-insurance benefits from both payroll taxes and income taxes. As the percentage of total medical costs attributable to the costs of drugs has risen, the

---

<sup>40</sup> See Yan Song, Ying Bian, and Tianmin Zhen, "Making Medicines More Accessible in China: An Empirical Study Investigating the Early Progress of Essential Medicine System," *PLoS ONE* (2018), <https://doi.org/10.1371/journal.pone.0201582>; Zhongliang Zhou et al., "The Financial Impact of the 'Zero-Markup Policy for Essential Drugs' on Patients in County Hospitals in Western Rural China," *ibid.* (2015), DOI:10.1371/journal.pone.0121630. For analysis of the impact of the system on over-prescription, see Wenhui Mao, Yunyu Huang, and Wen Chen, "An Analysis on Rational Use and Affordability of Medicine after the Implementation of National Essential Medicines Policy and Zero Mark-up Policy in Hangzhou, China," *ibid.* (2019), <https://doi.org/10.1371/journal.pone.0213638>.

<sup>41</sup> See Patricia Danzon, ed. *Price Comparisons for Pharmaceuticals: A Review of U.S. And Cross-National Studies* (1999); Scherer, "The Pharmaceutical Industry -- Prices and Progress."

<sup>42</sup> See Mark Lemley, Lisa Larrimore Ouellette, and Rachel Sachs, "The Medicare Innovation Subsidy," *New York University Law Review* 95 (2020).



percentage of health-insurance plans that cover such costs – and thus the magnitude of the subsidy generated by the tax deductions – has grown.<sup>43</sup> The Patient Protection and Affordable Care Act has increased the scale of these strategies (most importantly, by expanding Medicaid eligibility and by increasing pressure on employers to offer insurance benefits) and added a third type of governmental support for insurance (subsidies given to poor individuals who obtain health insurance through insurance exchanges) but has not fundamentally altered the general approach that the United States uses to address the access issue.

The government of England currently uses an unusual combination of insurance and indirect price regulation to enhance its citizens' access to pharmaceutical products. The National Health Service reimburses patients for all (or almost all) of the cost of drugs that have received affirmative evaluations from NICE, the National Institute for Health and Clinical Excellence. NICE, in turn, takes into account the price of drugs when deciding whether they are sufficiently cost effective to warrant recommendation. The net effect is to put pressure on pharmaceutical firms to lower the prices of drugs, lest they not receive NICE's imprimatur. The high cost to the government of the reimbursements may contribute to the slow pace at which NICE makes its evaluations, but drugs that do receive one of its positive assessments are readily available to everyone who needs them.<sup>44</sup>

#### 4. *Gaps and Conflicts*

As we have seen, in the United States the three dimensions of governmental management of pharmaceutical products are handled through different statutory mechanisms administered by different government agencies. Occasionally, Congress pays attention to more than one dimension simultaneously and attempts to make the pieces fit together. The clearest example is the Hatch-Waxman Act, which was mentioned above. For the most part, however, the three zones are autonomous. No governmental institution has the power or incentive to coordinate them.

The lack of coordination has unfortunate effects. To be sure, every now and then, an initiative in one sector will generate fortuitous benefits in another sector. For instance, the new rules governing follow-on biologics (designed for safety) may have the incidental effect of increasing the costs borne by generic firms, which in turn will raise barriers to entry into markets for pioneering drugs whose patents have expired, which in turn will increase incentives for innovation in novel biologics.<sup>45</sup> Much more often, however, the failure of the designers or managers of one sector to take into account impacts on the other sectors lead to one of two problems: Either their initiatives needlessly exacerbate the problems that the other sectors are trying to solve, or no one takes responsibility for a particular issue, and it falls through the cracks.

---

<sup>43</sup> See Scherer 929; Weisbrod 1991 523-26; CBO4 47-48; Berndt 2010; Lackawalla.

<sup>44</sup> See Joshua Cohen et al., "Comparing Patient Access to Pharmaceuticals in the UK and US," *Appl Health Econ Health Policy* 5, no. 3 (2006).

<sup>45</sup> Cf. Henry Grabowski, Ian Cockburn, & Genia Long, *The Market for Follow-On Biologics: How Will It Evolve?*, 25 *Health Aff.* 1291 (2006).

The most serious manifestation of the first type of problem involves cost. Our reliance upon the patent regime and data-exclusivity rules to stimulate innovation causes (indeed, depends upon) an increase in the price of drugs, which in turn increases the difficulty of ensuring that the people who need those drugs have access to them. In other words, the way we approach the incentive problem exacerbates the access problem. A less obvious contributing factor: our continued reliance upon the “gold standard” of clinical testing to ensure the safety and efficacy of drugs (even in settings where that approach has proven less than optimal) increases the cost of securing approval for new drugs, which in turn necessitates extensions of the term of patent protection (to enable the firms to recoup those costs), which in turn further worsens the “access” problem.<sup>46</sup> Last but not least, our heavy reliance upon insurance (rather than price controls or procurement) to overcome the access problem raises costs still further, by reducing the incentives for consumers or physicians to engage in cost/benefit analyses when selecting medicines, which in turn reduces the reasons for manufacturers to set limits on prices.<sup>47</sup>

This last dynamic is curbed to some extent by the cost sensitivity of private insurers, who strive in various ways to curb reimbursements for especially expensive drugs.<sup>48</sup> However, pressure from physicians and consumers and incomplete coordination among the insurers when making formulary decisions limit the effectiveness of this check.<sup>49</sup>

The net results: drug prices in the United States are among the highest in the world; the US market for drugs is by far the largest in the world (currently accounting for roughly 40% of the global market<sup>50</sup>); and the research efforts of pharmaceutical firms focus disproportionately on diseases common in the United States.

The dynamic is no secret. In various ways, the insurers are trying to mitigate it – for instance, by demanding the right to participate in the choice of medicines and by adjusting co-payments to try to nudge consumers toward generic alternatives to branded drugs.<sup>51</sup> But these remedies are at best palliative. To cure this problem, we would have to alter fundamentally the way in which we deal with at least one of the three dimensions.

The second example of this type of problem is less well known but equally serious: We currently rely too heavily on medicines, which cure (or relieve the symptoms of) diseases after they have been contracted, and too little on vaccines, which prevent diseases in the first instance. The data are chilling. Only 54 vaccines are currently licensed for use

---

<sup>46</sup> See Eisenberg, "The Role of the Fda in Innovation Policy."346; David A. Kessler, Rose, Janet L, Temple, Robert J., Schapiro, Renie and Griffin, Joseph P., "Therapeutic Class Wars -- Drug Promotion in a Competitive Marketplace," *New England Journal of Medicine* 331, no. 2 (1994).

<sup>47</sup> Congressional Budget “Congressional Budget Office”, "Research and Development in the Pharmaceutical Industry," (2006): 4-5.

<sup>48</sup> See, e.g., Engineering “National Academies of Sciences, and Medicine”, "Making Medicines Affordable: A National Imperative," ed. The National Academies Press. (Washington, DC2018).

<sup>49</sup> See Joshua Cohen et al., "Comparing Patent Access."

<sup>50</sup> See Berndt and Newhouse, "Pricing and Reimbursement in U.S. Pharmaceutical Markets."

<sup>51</sup> See Darius Lakdawalla, "Insurer Bargaining and Negotiated Drug Prices in Medicare Part D\*," in *Petrie-Flom Drugs Conference* (2009).

in the United States,<sup>52</sup> and the major pharmaceutical firms are investing discouragingly little money in research designed to develop new ones. As a result, the percentage of drugs approved each year by the FDA that consist of vaccines has been dropping in recent years. From a high of 14% in 2006-2008, it has now fallen to 5%.<sup>53</sup>

In a classic essay, Burton Weisbrod offered the following illustration of the relative merits of vaccines and cures. In the early 20<sup>th</sup> century, he pointed out, we lacked any effective treatment for polio. The result was that the total health care costs associated with polio were low. “Many victims of the disease died quickly as a result of paralysis; for them, the effects were disastrous, but the attendant health care costs were small.” The development and deployment of iron-lung technology “prolonged life, but at substantial cost.” Those costs remained high, until the development of polio vaccines (Sabin and Salk), whose widespread distribution (in the United States) virtually eliminated the disease. (There were 38,000 cases in 1954; 5 cases in 1985.) The result is that we now devote virtually no resources to combatting polio.<sup>54</sup> The lesson is plain: vaccines have enormous potential both to alleviate suffering and to reduce costs.

Why, then, are we neglecting vaccines? Several factors seem to be at work. Some are not directly relevant to our inquiry here. For instance, the methods by which vaccines have traditionally been produced are more expensive than the methods used to produce most medicines – and thus the potential profits they can generate are smaller. In addition, some analysts think that, even after a modest adjustment of the relevant products-liability regime, the large potential damages to which vaccine producers are potentially exposed discourages entry.<sup>55</sup> And so forth.

But some of the contributing causes do implicate the three dimensions of governmental management that we have outlined. For example, high-profile scandals involving impure vaccines have resulted in the imposition on vaccine producers of unusually tight and costly safety regulations. Even more problematic may be the understandable efforts of the administrators of the vaccine procurement programs to use their bargaining power to drive down costs. Their success in that regard helps the current generation, by getting existing vaccines into their mouths cheaply, but may hurt the next generation, by reducing incentives to hunt for new vaccines. In short, our efforts to promote safety (sector 2) and to increase access (sector 3) have had the unfortunate effect of exacerbating the inadequate incentives to innovate in this area (sector 1).

Nor can the government respond to the underproduction of vaccines by dialing up incentives – because it has no dials to turn. As we have seen, in order to stimulate and

---

<sup>52</sup> FDA, “Vaccines Licensed for Use in the United States,” <https://www.fda.gov/vaccines-blood-biologics/vaccines/vaccines-licensed-use-united-states> (current as of 11/27/2019) (counting identical vaccines manufactured by more than one company as one vaccine).

<sup>53</sup> See Jonathan J. Darrow, Michael S. Sinha, and Aaron S. Kesselheim, “When Markets Fail: Patents and Infectious Disease Products,” *Food and Drug Law Journal* 73 (2018): 364.

<sup>54</sup> Burton Weisbrod, “The Health Care Quadrilemma: An Essay on Technological Change, Insurance, Quality of Care, and Cost Containment,” *Journal of Economic Literature* 29, no. 2 (1991).

<sup>55</sup> See Finkelstein, “Static and Dynamic Effects of Health Policy: Evidence from the Vaccine Industry,” *Quarterly Journal of Economics* (2004).

guide applied research, we rely in the United States almost exclusively upon market signals. Unusual characteristics of the market for vaccines (such as the inability of sellers to monetize the positive externalities associated with vaccine consumption and the tendency of potential consumers to underestimate the risks of contacting the diseases to which they pertain) make those signals especially unreliable.<sup>56</sup>

In sum, our current regime is analogous to a situation in which a patient has three doctors, each concerned with a different ailment. Each physician prescribes a medicine designed to alleviate the condition with which he is concerned, but without considering the impact on the other two conditions or on the efficacy of the medicines prescribed by the other two doctors. The result is rarely beneficial and sometimes catastrophic.

Adverse interaction of these sorts is not the only drawback of our current regime. Equally important is inattention to some crucial issues. Questions that fall into no one's portfolio are ignored – sometimes at great social cost. The two most fundamental gaps are summarized below.

The pharmaceutical industry currently devotes too many resources to generating drugs that offer at best modest therapeutic advantages over existing drugs and devotes too few resources to pursuing genuine breakthroughs. Drugs of the first type are sometimes known as “me-too” drugs, a term that reflects the fact that they are frequently members of the same family as an existing drug and operate similarly. But it is more accurate to think of drugs as arrayed along a spectrum. At one extreme are those that, although safe and effective (as those terms are interpreted by the FDA) are no better for any patient than existing drugs. At the opposite extreme are those that have enormous comparative advantages. Some of the follow-on statins (for heart disease) and tricyclic anti-depressants fall near the left end of the spectrum,<sup>57</sup> Sovaldi, the first drug to offer a permanent cure for hepatitis C, falls near the opposite end, and Harvoni, a successor to Sovaldi with significant advantages, falls near the middle.<sup>58</sup> The problem, then, is that the current system is tilted in favor of drugs that are closer to the first end of the spectrum.

One manifestation of this bias is the modest size of the subset of drugs that the FDA deems worthy of “priority review.” To appreciate this indicator requires a bit of background: The FDA currently uses several procedural devices to accelerate evaluations

---

<sup>56</sup> See Michael Kremer and Rachel Glennerster, *Strong Medicine: Creating Incentives for Pharmaceutical Research on Neglected Diseases* (Princeton, N.J.: Princeton University Press, 2004), , 29ff.

<sup>57</sup> See Jeffrey K. Aaronson and A. Richard Green, "Me-Too Pharmaceutical Products: History, Definitions, Examples, and Relevance to Drug Shortages and Essential Medicines Lists," *British Journal of Clinical Pharmacology* 86 (2020). Statins in general have large health benefits, see, e.g., Rory Collins et al., "Interpretation of the Evidence for the Efficacy and Safety of Statin Therapy," *The Lancet* 388 (2016)., but Crestor has not been shown to be significantly better than Lipitor, its major predecessor.

<sup>58</sup> See Laura Fegraus and Murray Ross, "Sovaldi, Harvoni, and Why It's Different This Time," *Health Affairs* (2014), <https://www.healthaffairs.org/doi/10.1377/hblog20141121.042908/full/>.

of drugs that promise significant health benefits.<sup>59</sup> Of these, the differentiation of drugs according to “priority” is the most important. The agency describes its practice as follows:

A Priority Review designation means FDA’s goal is to take action on an application within 6 months (compared to 10 months under standard review). A Priority Review designation will direct overall attention and resources to the evaluation of applications for drugs that, if approved, would be significant improvements in the safety or effectiveness of the treatment, diagnosis, or prevention of serious conditions when compared to standard applications.

Significant improvement may be demonstrated by the following examples:

- evidence of increased effectiveness in treatment, prevention, or diagnosis of condition;
- elimination or substantial reduction of a treatment-limiting drug reaction;
- documented enhancement of patient compliance that is expected to lead to an improvement in serious outcomes; or
- evidence of safety and effectiveness in a new subpopulation.<sup>60</sup>

For present purposes, the significance of this system is that it provides an indication of how many of the drugs presented for FDA review are considered by the agency to “significant improvements in the ... treatment, diagnosis, or prevention of serious conditions.” In 2019, 58% of the 48 novel drugs approved by the agency received priority review. This is a greater proportion than in years past,<sup>61</sup> but it still means that almost half of the approvals were for drugs that were not expected to have significant health benefits.<sup>62</sup> The other pertinent classifications used by the agency are even more worrisome: Only 35% of the approved drugs were designated “fast-track” (i.e., were deemed to have “the potential to address unmet medical needs”) and only 27% were designated “breakthroughs” (i.e., were deemed “drugs for serious or life-threatening diseases for which there is unmet medical need and for which there is preliminary clinical evidence demonstrating that the drug may result in substantial improvement on a clinically significant endpoint ... over other available therapies”).<sup>63</sup> Most knowledgeable analysts of the pattern of drug development and approval in the United States come to the same conclusion: Too many resources are being devoted to the creation of drugs from which we benefit little.<sup>64</sup>

---

<sup>59</sup> See U.S. Department of Health and Human Services, “Guidance for Industry: Expedited Programs for Serious Conditions — Drugs and Biologics,” (2014), <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/expedited-programs-serious-conditions-drugs-and-biologics>.

<sup>60</sup> U.S. Food and Drug Administration, “Priority Review,” <https://www.fda.gov/patients/fast-track-breakthrough-therapy-accelerated-approval-priority-review/priority-review>.

<sup>61</sup> 59% of NMEs licensed in the United States between 1990 and 2004 consisted of “me-toos.”

<sup>62</sup> Food and Drug Administration, “Advancing Health through Innovation: New Drug Therapy Approvals 2019,” (2020), 22.

<sup>63</sup> *Ibid.*, 21.

<sup>64</sup> See, e.g., Jerry Avorn; Marcia Angell, *The Truth About the Drug Companies: How They Deceive Us and What to Do About It* (New York: Random House, 2004); Mark Dugan and Fiona Scott Morton, “The

This judgment is not universally shared, however. Defenders of the current system point out that many of the so-called “me-too” drugs (such as the newer SSRIs for depression) are better than older drugs in the same family for modest groups of patients. And even when the newcomers are functionally equivalent to their predecessors, their presence in the market may lead to price competition, which would then make all drugs more affordable.<sup>65</sup>

These arguments have been persuasively rebutted by Aidan Hollis.<sup>66</sup> As he points out, me-too drugs can be approved only after surviving the standard three rounds of clinical testing. The substantial costs of those tests would surely produce greater benefits to public health had they been devoted to medical problems for which we do not yet have solutions. In addition, at least in the United States, the entry of a me-too drug into a market already occupied by a pioneer rarely results in significant price competition. Instead, the me-too is typically introduced at or near the price point of the original, and the price of the original does not significantly decline. To be sure, the arrival of the me-too typically does cut into the market share of the pioneer. But that’s a bug, not a feature, because it corrodes incentives to develop pioneering drugs in the first instance. Even if one believes (as do the defenders of the current regime) that Hollis overstates the relevant evidence,<sup>67</sup> there is little doubt that the social benefits of resources devoted to drugs that fall into the same class as efficacious and safe existing drugs are lower than the social benefits of resources devoted to first-in-class drugs.

The second example is simpler – and, for our purposes, even more important. The current combination of incentives and regulatory regimes directs resources toward research projects that promise to generate drugs for which there are large and lucrative markets, at the expense of projects that would have larger net health benefits but would generate fewer profits.<sup>68</sup> A market, to be lucrative market, must include a large number of persons suffering from a particular ailment who have both the ability and the willingness to pay substantial sums for protection or relief. The large (and in most cases growing) sets of people suffering from noncommunicable diseases in high-income countries (and above all, the United States) means that lucrative markets for drugs that address all of those diseases exist. By contrast, the markets for the equally deadly infectious diseases now concentrated in developing countries are much smaller.

The impact on the patterns of health-related research and development has been dramatic. The shares of total investment and of clinical trials devoted to infectious diseases

---

Distortionary Effects of Government Procurement: Evidence from Medicaid Prescription Drug Purchasing," *Quarterly Journal of Economics* 71, no. 1 (2006).

<sup>65</sup> See Joseph A. DiMasi and Cherie Paquette, "The Economics of Follow-on Drug Research and Innovation: Trends in Entry Rates and the Timing of Development," *Pharmacoeconomics* 22 (2004).

<sup>66</sup> Aidan Hollis, "Me-Too Drugs: Is There a Problem?," (2004), [https://www.who.int/intellectualproperty/topics/ip/Me-tooDrugs\\_Hollis1.pdf](https://www.who.int/intellectualproperty/topics/ip/Me-tooDrugs_Hollis1.pdf).

<sup>67</sup> See Joseph A. DiMasi, "Comment on “Me-Too Drugs: Is There a Problem?”," (2005), <https://www.who.int/intellectualproperty/forum/HollisResponse.pdf>.

<sup>68</sup> Among the many sources exploring this problem are Kremer and Glennerster, *Strong Medicine*; Michael R. and Dranove Ward, David, "The Vertical Chain of Research and Development in the Pharmaceutical Industry," *Economic Inquiry* 33, no. 1 (1995).

have long been well below the shares that would match the global disease burdens associated with those diseases.<sup>69</sup> Investment in the neglected tropical diseases have been especially low – less than 1% of the global total.<sup>70</sup> These biases are confirmed by other indicators: Of clinical trials, 89% focus on Type I diseases, 9.1% focus on Type II diseases, and 1.9% focus on Type III diseases.<sup>71</sup> And at the end of the research chain, the percentages of drug approvals that involve anti-microbial drugs are low – and have been declining since the 1980s.<sup>72</sup>

In short, the most important side-effect of the way in which high-income countries manage pharmaceutical products has been underfunding research on vaccines and on drugs aimed at the set of diseases that disproportionately afflict the residents of poor countries.

---

<sup>69</sup> See Darrow, Sinha, and Kesselheim, "When Markets Fail."

<sup>70</sup> See Rottingen et al., "Mapping R&D Data," 1303.

<sup>71</sup> See *ibid.* This categorization was discussed in the Introduction. See pages \_\_\_\_, *supra*. For itemization of the diseases that fall into each category, see WHO Secretariat, "Defining Disease Types I, II, and III (2012), [https://www.who.int/phi/3-background\\_cewg\\_agenda\\_item5\\_disease\\_types\\_final.pdf](https://www.who.int/phi/3-background_cewg_agenda_item5_disease_types_final.pdf).

<sup>72</sup> Darrow, Sinha, and Kesselheim, "When Markets Fail."

## **B. Low and Middle-Income Countries**

As sources of both causes and potential solutions to the global health crisis, the systems used by the governments of LMICs to manage pharmaceutical products are as important as the systems used by UICs. It would be infeasible to catalogue all of the systems found in the developing world. In this section, we examine five countries that, collectively, are reasonably representative: Malawi, Namibia, Cambodia, Thailand, and the Plurinational State of Bolivia [hereinafter “Bolivia”].

The following factors contributed to our selection of these nations: Two are located in subSaharan Africa, the region where, as we have seen, the greatest burdens from infectious diseases are currently found; two are located in Southeast Asia, the next-most afflicted region, and one is in South America, the third in line. None of the five countries is currently involved in warfare or violent civil strife, which would distort our analysis of their health-care institutions or complicate our efforts to suggest reforms. Finally, the authors are already providing advice to the governments of two of the countries – Malawi and Namibia – and thus happen to know a fair amount about them.

### *Background*

The following table presents some basic information about these five countries – and compares them to the United States.



Table 2

	Malawi	Cambodia	Bolivia	Namibia	Thailand	USA
Population (2018) <sup>73</sup>	18,143,310	16,249,800	11,353,140	2,448,260	69,428,520	327,167,430
Gross National Income per capita (nominal) (2018) <sup>74</sup>	\$360	\$1,380	\$3,370	\$5,250	\$6,610	\$62,850
Gross National Income per capita (PPP) (2018) <sup>75</sup>	\$1,310	\$4,060	\$7,670	\$10,920	\$18,200	\$63,390
GINI coefficient (2019) <sup>76</sup>	46.1	37.9	47	59.7	44.5	45
IHDI (2018) <sup>77</sup>	0.346	0.465	0.533	0.418	0.635	0.797
Healthy Life Expectancy (2016) <sup>78</sup>	56.2	60.8	63.0	55.9	66.8	68.5
Infectious Disease Burden (2016) <sup>79</sup>	16,300	4,000	2,867	14,900	2,462	500
Infectious Disease Mortality (2016) <sup>80</sup>	250	66	41	250	52	17
Healthcare expenditure (% of GDP) <sup>81</sup>	9.83%	6.08%	6.86%	9.12%	3.71%	17.07%
Physicians per 100,000 population <sup>82</sup>	1.57	16.82	161.11	37.21	80.96	259.48

<sup>73</sup> Source: World Bank, "Population by Country," <https://data.worldbank.org/indicator/SP.POP.TOTL>.

<sup>74</sup> Source: World Bank, "GNI per capita, Atlas Method (current US\$)," [https://data.worldbank.org/indicator/ny.gnp.pcap.cd?year\\_high\\_desc=true](https://data.worldbank.org/indicator/ny.gnp.pcap.cd?year_high_desc=true).

<sup>75</sup> Source: World Bank, "GNI per capita, PPP (current international \$)," [https://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD?year\\_high\\_desc=true](https://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD?year_high_desc=true).

<sup>76</sup> The GINI coefficient is the most commonly used measure of income inequality. All data are drawn from: World Population Review, "Gini Coefficient by Country, 2019," <http://worldpopulationreview.com/countries/gini-coefficient-by-country/>.

<sup>77</sup> The Inequality Human Development Index (IHDI) combines several measures of economic and social development – and then adjusts the combination downward to take into account the impact of economic inequality. These data are derived from United Nations Development Programme, Inequality Human Development Index (IHDI), Country Profiles," <http://hdr.undp.org/en/countries/profiles/MWI>; <http://hdr.undp.org/en/countries/profiles/KHM>; <http://hdr.undp.org/en/countries/profiles/HTI>; <http://hdr.undp.org/en/countries/profiles/NAM>; <http://hdr.undp.org/en/countries/profiles/USA>.

<sup>78</sup> Source: World Health Organization, "Healthy Life Expectancy: Data by Country," <https://apps.who.int/gho/data/node.main.HALE?lang=en>.

<sup>79</sup> Measured in DALYs per year per 100,000 population. All data are from World Health Organization, "Disease Burden and Mortality Estimates: WHO Member States, 2016," [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/index1.html](https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html).

<sup>80</sup> Measure in deaths per year per 100,000 population. All data are from Ibid.

<sup>81</sup> Source: World Bank, "Current Health Expenditure (% of GDP)," <https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS>. Although this database is current as of 2019, the numbers for all five countries come from 2016.

<sup>82</sup> Source: World Health Organization, "Medical Doctors," [http://apps.who.int/gho/data/node.main.HWFGRP\\_0020?lang=en](http://apps.who.int/gho/data/node.main.HWFGRP_0020?lang=en). Unfortunately, these numbers come from different years and thus provide only a rough indication of the relative numbers of medical doctors in the five countries. The number for Malawi is not a misprint.

Malawi is a small, landlocked country in eastern Africa. It is currently one of the poorest countries in the world; its GNI per capita (whether measured in raw dollars or using the purchase-power-parity method) places it close to the bottom of the list of countries. In terms of inequality of income, however, it is roughly comparable to the United States – and less unequal than some of its neighbors, such as South Africa and Botswana.

19% of the roughly 18 million residents of Malawi live in cities; 81% live in the countryside. Agricultural occupations predominate. Until recently, tobacco was the main crop, but declining prices and international boycotts of Malawi tobacco (triggered by reports of child labor) are prompting many farmers to shift to soybeans, tea, and sugar.<sup>83</sup>

Malawi has a relatively stable democratic system of government. Currently, the dominant party is the Democratic Progressive Party, led by President Peter Mutharika.

Life expectancy in Malawi is much lower than in the United States – or in other UICs. The main cause of the discrepancy is the prevalence of infectious diseases. The diseases that weigh most heavily (measured by DALYs per 100,000 residents) are HIV (8,521), malaria (2,747), diarrhoeal diseases (2,297), meningitis (626), and tuberculosis (623).<sup>84</sup>

Malawi's health-care system has four sectors: a public sector funded and run by the government; a for-profit private sector; a non-profit private sector (mission hospitals and the Christian Health Association of Malawi [CHAM]); and an “informal” sector (traditional healers, herbalists, and prophets).<sup>85</sup> Usage of the informal sector, particularly in rural areas, is high. For example, one study found that, of persons with chronic noncommunicable diseases, 37.3% did not seek any medical care, 42.5% sought formal care, and 20.2% relied on informal care.<sup>86</sup> Among the formal sectors, the public sector is by far the largest. The relatively high ratio of total healthcare expenditure to the country's GDP (9.83%) is made possible by large subsidies to the public sector by international donors. Most medical services and medicines in the public sector currently are free; institutions in the private sectors charge modest fees. However, the availability of essential medicines in both public and private distribution facilities varies radically.<sup>87</sup> The quality

---

<sup>83</sup> See *The Economist*, “Country Report: Malawi,” September 26, 2019.

<sup>84</sup> All data are from World Health Organization, “Disease Burden and Mortality Estimates: WHO Member States, 2016,” [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/index1.html](https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html).

<sup>85</sup> See Ariane McCabe et al., “Private Sector Pharmaceutical Supply and Distribution Channels in Africa: A Focus on Ghana, Malawi and Mali,” in *HNP Discussion Paper* (World Bank, 2011), 12.; Emily Fisher, Rebecca Lazarus, and Ramin Asgary, “Attitudes and Perceptions Towards Access and Use of the Formal Healthcare Sector in Northern Malawi,” *Journal of Health Care for the Poor and Underserved* 28, no. 3 (2017).

<sup>86</sup> See Qun Wang et al., “Health Seeking Behaviour and the Related Household out-of-Pocket Expenditure for Chronic Non-Communicable Diseases in Rural Malawi,” *Health Policy and Planning* 30 (2015).

<sup>87</sup> The most comprehensive study found that: “[t]he overall availability of medicines in various sectors was 48.5% for public, 71.1% for retail pharmacies, 62.9% for CHAM and 57.5% for private clinics. Availability of medicines varied from as low as 0% of ethosuximide tablets in all sectors to 100% of amoxicillin capsules/tablets and cotrimoxazole tablets in all health facilities.” Felix Khuluza and Christine Haefele-Abah, “The Availability, Prices and Affordability of Essential Medicines in Malawi: A Crosssectional Study,” *PLoS ONE* 14, no. 2 (2019).

of the services in the private sectors are widely thought to be better than the public sector. All sectors are desperately short of trained medical doctors, but the shortage is greatest in the public sector.

The systems for distributing drugs in Malawi are imperfect. Poor storage conditions cause some medicines to degrade, and imperfections in the supply chain frequently result in stock-outs in hospitals and pharmacies.<sup>88</sup>

\* \* \* \* \*

Namibia is located roughly a thousand miles to the southwest of Malawi. Its land area is much larger, but its population is smaller: roughly 2.7 million residents. The paucity of people is related to its climate; Namibia is extremely dry and becoming more so. Two thirds of its population live in rural areas.

Namibia is nowhere near as impoverished as Malawi. The GNI per capita of \$5,250 places it slightly above the boundary (set by the World Bank) between lower-middle-income and upper-middle-income countries. However, severe inequality of both income and wealth means that most residents are very poor.

In other respects, Namibia resembles Malawi. It has a stable democratic system of government. Healthy life expectancy in the two countries is nearly identical. Infectious diseases are common, although the set of diseases that are most problematic is somewhat different. (The most burdensome in Namibia (measured by DALYs per 100,000 residents) are HIV (10,391), diarrhoeal diseases (1681), tuberculosis (1383), meningitis (362), and malaria (326).)<sup>89</sup>

As in Malawi, health care in Namibia is delivered through four main sectors: a large public sector, used most heavily by the poor, a much smaller for-profit private sector, a modest nonprofit private sector, and an informal sector. Medicines distributed by public-sector pharmacies and hospitals are free, but the quality of services in the public sector is generally considered low, primarily because of the shortage of qualified staff. Private health insurance (typically used to cover services and medicines in the private sector), is available, but less than 20% of the population is able to afford it.<sup>90</sup>

Almost all pharmaceutical products are imported. Typically, they arrive at the Central Medical Stores in Windhoek, where they are kept until they are distributed to hospitals and pharmacies. Neither the Central Medical Stores nor most hospitals have facilities for controlling storage temperatures.

---

<sup>88</sup> See McCabe et al., "Pharmaceutical Supply in Africa," 25-26.

<sup>89</sup> All data are from World Health Organization, "Disease Burden and Mortality Estimates: WHO Member States, 2016," [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/index1.html](https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html).

<sup>90</sup> The insurance is provided by ten "medical aid funds," run by for-profit administrators. Six are limited to the employees of particular firms or institutions, but four are open to members of the public. See Benedikt Brockmeyer, "The Health System in Namibia: Deliberations About an Affordable National Health Insurance for the Low-Income Workforce in Namibia," (2012), 2-5.

\* \* \* \* \*

Cambodia is as damp as Namibia is dry. For most of the twentieth century, the country suffered from waves of colonization, war, and genocide, but is now relatively peaceful. Formally, its government combines an elective constitutional monarchy with a multiparty democracy, but in practice it is authoritarian, dominated by the Cambodian People's Party and Hun Sen, the longtime Prime Minister.

Cambodia's GNI per capita is low enough that it, like Malawi, has been designated by the United Nations a "least developed country." However, a high economic growth rate and modest levels of income inequality have enabled the country in recent years to reduce significantly the poverty rate. The major industries are agriculture, textiles, and tourism.

The most burdensome infectious diseases in Cambodia (measured by DALYs per 100,000 residents) are tuberculosis (812), diarrhoeal diseases (739); HIV (638); meningitis (192); and Hepatitis B (147).<sup>91</sup> The burden associated with malaria is modest (only 6 DALYs per 100,000 residents), but the high percentage of drug-resistant strains in the western part of the country poses a severe long-term threat, not just to the population of Cambodia, but also to the rest of the world.<sup>92</sup>

Decimated during the period in which the country was controlled by the Khmer Rouge, the healthcare system in Cambodia has gradually been rebuilt, partly with major donations from international organizations. The net result has been a sharp improvement in life expectancy.<sup>93</sup>

The overall structure of the healthcare system in Cambodia parallels those of Malawi and Namibia, but the private sector is proportionally much larger, and the public sector much smaller than in either of those countries. One consequence is that (as of 2014) 62% of total health expenditures consisted of out-of-pocket payments by patients – an extremely high number.<sup>94</sup> Some employers offer health insurance, but the percentage of

---

<sup>91</sup> All data are from World Health Organization, "Disease Burden and Mortality Estimates: WHO Member States, 2016," [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/index1.html](https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html).

<sup>92</sup> See Arjen M. Dondorp et al., "Artemisinin Resistance in Plasmodium Falciparum Malaria," *New England Journal of Medicine* 361 (2009).; Richard J Maude et al., "The Last Man Standing Is the Most Resistant: Eliminating Artemisinin-Resistant Malaria in Cambodia," *Malaria Journal* 8, no. 31 (2009). ("The model predicts that if there is no intervention, and use of artemisinin monotherapies continues, there will be an exponential rise in the proportion of resistant infections and a slowly increasing prevalence of infection. By 2030, the model predicts that the prevalence of malaria will have doubled compared to 2008 and resistance to the artemisinins will be approaching 100%.")

<sup>93</sup> See WHO, "Cambodia-Who Country Cooperation Strategy 2016-2020," (2016), 2.; Khim Keovathanak and Peter Leslie Annear, "The Transition to Semi-Autonomous Management of District Health Services in Cambodia: Assessing Purchasing Arrangements, Transaction Costs, and Operational Efficiencies of Special Operating Agencies," in *Improving Health Sector Performance: Institutions, Motivations and Incentives*, ed. Hossein Jalilian and Vicheth Sen (2011).

<sup>94</sup> See WHO, "Cambodia-Who Country Cooperation Strategy 2016-2020," 5-6. Cf. Wim Van Damme et al., "Out-of-Pocket Health Expenditure and Debt in Poor Households: Evidence from Cambodia," *Tropical Medicine and International Health* 9, no. 2 (2004). (showing that the percentage was even higher a decade earlier).

the population that is covered by it is small.<sup>95</sup> The national government, aided by the World Health Organization, seems determined to increase the quality and accessibility of health care by establishing a broad social-security system, but progress toward that goal has been slow.<sup>96</sup>

\* \* \* \* \*

Thailand, located immediately to the west of Cambodia, is more prosperous and populous. Its nominal GNI per capita of \$6,610 is slightly above that of Namibia, placing it too in the category of upper-middle-income countries. Despite a series of political convulsions in the late 20<sup>th</sup> century and early 21<sup>st</sup> centuries, the Thai economy has grown at an impressive pace, powered by a combination of manufacturing, large-scale agriculture, and tourism.<sup>97</sup> Adult literacy is high, and unemployment is low.

Two unrelated characteristics make Thailand's healthcare system unusual. First, it has a thriving business in what is sometimes called "medical tourism." Residents of other countries (most of them from the middle class) frequently travel to Thailand to receive surgical or other services, which are both high-quality and (for them) affordable. (Some combine such trips with vacations in Thailand; hence the odd label for this practice.) For wealthy residents of Thailand, medical tourism has had the incidental benefit of increasing the sophistication of the facilities and physicians available locally – although at the cost of reducing the ability of the Thai middle class to afford those services.<sup>98</sup>

Second, since 2002, Thailand has had a system of universal health care. Today, residents not covered by insurance and unable to afford private health care can obtain, for free, care in regional public hospitals (most of them publicly funded) and, if necessary, secondary and tertiary-care facilities. 75% of the Thai population uses the system. Low funding rates and a shortage of doctors (partly caused by a "brain drain" from the public to the private sector fueled by medical tourism) limit the quality of care in the system, but it is still substantially better than that available to poor residents of most similarly situated countries.<sup>99</sup>

---

<sup>95</sup> See Sopheap Ly, "Social Health Insurance in Cambodia: An Analysis of the Health Care Delivery Mechanism," in *Improving Health Sector Performance: Institutions, Motivations and Incentives*, ed. Hossein Jalilian and Vicheth Sen (2011).

<sup>96</sup> See WHO, "Cambodia-Who Country Cooperation Strategy 2016-2020."; Ly, "Social Health Insurance in Cambodia: An Analysis of the Health Care Delivery Mechanism."

<sup>97</sup> See <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=TH>. The only major exception was during the Asian economic crisis between 1996 and 1999, from which the country recovered quickly, in part because of robust exports.

<sup>98</sup> See Erik Cohen, "Medical Tourism in Thailand," *AU-GSB e-Journal* 1, no. 1 (2008); Nicola S. Pocock and Kai Hong Phua, "Medical Tourism and Policy Implications for Health Systems: A Conceptual Framework from a Comparative Study of Thailand, Singapore and Malaysia," *Globalization and Health* 7, no. 12 (2011).

<sup>99</sup> See Seung Chun Paek, Nathani Meemon, and Thomas T.H. Wan, "Thailand's Universal Coverage Scheme and Its Impact on Health-Seeking Behavior," *SpringerPlus* 5 (2016); Viroj Tangcharoensathien et al., "Monitoring and Evaluating Progress Towards Universal Health Coverage in Thailand," *PLOS Medicine* 11, no. 9 (2014); Vasoontara Yiengprugsawan, Matthew Kelly, and Adrian C. Sleight, "The First 10 Years of the Universal Coverage Scheme in Thailand: Review of Its Impact on Health Inequalities and Lessons Learnt for Middle-Income Countries," *Australas epidemiol.* 17, no. 3 (2010); Viroj

Despite these advantages, Thailand still has a serious problem with infectious diseases. Indeed, its HIV burden (1,205 DALYs per 100,000 residents) is double that of Cambodia. The next most burdensome diseases are tuberculosis (299), diarrhoeal diseases (274); and meningitis (96).<sup>100</sup>

\* \* \* \* \*

Bolivia is the second most impoverished country in the western hemisphere, trailing only Haiti. It has long been highly stratified. Wealth and political power has been concentrated in the hands of the descendants of the Spanish colonizers. Members of the many indigenous groups, most living in the countryside, have been far worse off.

Until recently, the Bolivian health-care system was similarly stratified. The rich received decent care in the private sector, while the poor received low-quality care in the underfunded and understaffed public sector or relied on traditional medicines and services.<sup>101</sup> Partly as a result, life expectancy in the country was low – 56.0 in 2000, and 58.5 in 2005.<sup>102</sup>

In 2006, Evo Morales became the first Bolivian president of indigenous descent. Reforms designed to improve the lives of the rural poor followed quickly. With respect to health care, Morales instituted a system of incentives designed to reduce infant and maternal mortality, created several programs for augmenting the nutrition available to the poor, and cooperated with Cuba to increase the number of physicians in Bolivia.<sup>103</sup> Finally, just before his ouster as President in 2019, Morales announced the establishment of the Sistema Único de Salud (“SUS”), which would provide universal health care.<sup>104</sup>

The impact of these reforms has been substantial – but not as radical as was hoped.<sup>105</sup> Life expectancy in Bolivia is still lower than in any other South American country. Most relevant for our purposes is the continued incidence of infectious diseases. The most burdensome (measured by DALYs per 100,000 residents) are diarrhoeal diseases

---

Tangcharoensathien et al., "Promoting Universal Financial Protection: How the Thai Universal Coverage Scheme Was Designed to Ensure Equity," *Health Research Policy and Systems* 11, no. 25 (2013); Supon Limwattananon et al., "Why Has the Universal Coverage Scheme in Thailand Achieved a Pro-Poor Public Subsidy for Health Care?," *BMC Public Health* 12 (2012).

<sup>100</sup> All data are from World Health Organization, "Disease Burden and Mortality Estimates: WHO Member States, 2016," [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/index1.html](https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html).

<sup>101</sup> See, e.g., Ina Vandebroek et al., "Comparison of Health Conditions Treated with Traditional and Biomedical Health Care in a Quechua Community in Rural Bolivia," *Journal of Ethnobiology and Ethnomedicine* 4, no. 1 (2008); Henriette Bruun and Beth Elverdam, "Los Naturistas—Healers Who Integrate Traditional and Biomedical Explanations in Their Treatment in the Bolivian Health Care System," *Anthropology & Medicine* 13, no. 3 (2006).

<sup>102</sup> Source: <https://apps.who.int/gho/data/node.main.HALE?lang=en>.

<sup>103</sup> See Tim B Heaton et al., "Inequalities in Child Health in Bolivia: Has Morales Made a Difference?," *Health Sociology Review* 23, no. 3 (2014).

<sup>104</sup> See Morning Star, "Bolivia Introduces Health Care for All," *People's World*, March 4, 2019; Ernesto Londono, "Bolivian Leader Evo Morales Steps Down," *New York Times*, November 13, 2019.

<sup>105</sup> See Tim B Heaton et al., "Inequalities in Child Health in Bolivia: Has Morales Made a Difference?."

(806), HIV (414), Tuberculosis (386), Syphilis (167), Meningitis (130), and Chagas (130).<sup>106</sup>

In short, Bolivia has made great strides in the field of public health in general, and the fight against infectious diseases in particular. But whether Morales' successors will be both willing and able to implement his vision of universal, high-quality health care remains to be seen.

We now turn to how each of these nations have sought to address the three dimensions of pharmaceutical management.

### *Incentives*

As we saw, the United States currently uses a combination of government grants and intellectual-property law to provide incentives for the development of new pharmaceutical products (although only a modest proportion of the roughly \$115 billion per year in total R&D expenditures generated by those systems is applied to projects involving the infectious diseases that afflict developing countries). On a per capita basis, the expenditures by most other developed countries are similar.

Of the five developing countries we are considering, only Thailand employs the first of these strategies to any significant degree. Very recently, the Thai government has begun to use a combination of grants and tax breaks to fuel research in biotechnology.<sup>107</sup> To date, public investment in pharmaceutical research in the other four countries has been negligible.<sup>108</sup>

With respect to the second device – intellectual property law – the situation is more complicated and unstable. All five countries are members of the World Trade Organization and, as a result, are obliged to establish national patent systems that, very roughly speaking, resemble the system in place in the United States. (Much more detail concerning the scope of their obligations will be provided in the next chapter.) However, the degree to which they have thus far approximated the US model varies sharply.

---

<sup>106</sup> All data are from World Health Organization, "Disease Burden and Mortality Estimates: WHO Member States, 2016," [https://www.who.int/healthinfo/global\\_burden\\_disease/estimates/en/index1.html](https://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html).

<sup>107</sup> See "Interview: Nares Damrongchai – Ceo, Thailand Center of Excellence for Life Sciences (Tceels)," *Pharma Boardroom*, August 24, 2015; Jean-François Tremblay, "Thailand Embarks on Life Sciences Push: Reversing Its Long Neglect of R&D, Southeast Asian Country Now Encourages Biotechnology Innovation," *Chemical & Engineering News* 95, no. 21 (2017); Anna Rose Welch, "What to Know About Thailand's Life Sciences Industry," *Biosimilar Development*, May 12, 2017.

<sup>108</sup> See Rottingen et al., "Mapping R&D Data."

Malawi and Cambodia are both classified by the United Nations as “least developed countries”<sup>109</sup> and thus are not required by the relevant treaties to extend patent protection to pharmaceutical products until at least 2033.<sup>110</sup> They are free to do so, but neither has.

The other three countries are not considered “least developed” and thus must recognize pharmaceutical patents. In 2012, Namibia adopted a new patent statute, which (among other things) complied with this obligation. However, regulations essential to the implementation of the new statute have not yet been adopted. Reportedly, no patent on a pharmaceutical product is currently in force in Namibia.<sup>111</sup>

Bolivia is a member of the Andean Community of Nations and thus adheres to “Decision 486” of the community’s Common Intellectual Property Decree, which (among other things) governs the requirements for patent protection. Although that Decision declares pharmaceutical products to be patentable, Article 20(b) excludes from patent protection “inventions, when the prevention of the commercial exploitation within the respective Member Country of the commercial exploitation is necessary to protect human or animal life or health.”<sup>112</sup> In 2007, President Morales announced Supreme Decree 29004, which implemented that exclusion (and various other provisions of Bolivian law) by creating a “special procedure for the treatment of pharmaceutical products.” The Unit of Medicines and Health Technology, a governmental body separate from the Intellectual Property Service, was required to review all patents on such products to determine whether “the content and scope for which protection is sought ... interfere with the right to health and access to medicine.” A positive determination would result in rejection of the patent.<sup>113</sup> Since the adoption of this system, it appears that no pharmaceutical product patents have been issued in Bolivia.<sup>114</sup>

Of the five countries, the only one in which patent protection for pharmaceutical products is regularly invoked is Thailand. In 1992, strong pressure from the United States prompted Thailand to recognize patent protection for drugs.<sup>115</sup> Pharmaceutical firms quickly began to apply for and receive patents on new products.<sup>116</sup> However, in the judgment of the firms, Thailand’s law was insufficiently protective. Starting in 2003, as part of the prolonged negotiation of a Free Trade Agreement between the two countries,

---

<sup>109</sup> See [https://www.wto.org/english/thewto\\_e/whatis\\_e/tif\\_e/org7\\_e.htm](https://www.wto.org/english/thewto_e/whatis_e/tif_e/org7_e.htm).

<sup>110</sup> See “WTO Drugs Patent Waiver for LDCs Extended until 2033,” <https://www.un.org/ldcportal/wto-drugs-patent-waiver-for-ldcs-extended-until-2033/>.

<sup>111</sup> [Verify with BIPA].

<sup>112</sup> Andean Community, Decision 486, Common Intellectual Property Decree, <http://www.sice.oas.org/Trade/Junac/Decisiones/DEC486ae.asp#tit2c1>.

<sup>113</sup> Official Gazette of Bolivia, Supreme Decree No. 29004 (English translation by WIPO); Silvia Roxana Frias Villegas, Report SNP/2014/02118 (May 7, 2014), 2-3.

<sup>114</sup> [Recheck with Ramiro Moreno Baldivieso.]

<sup>115</sup> See Jakkrit Kuanpoth, “Compulsory Licences: Law and Practice in Thailand,” in *Compulsory Licensing: Practical Experiences and Ways Forward*, ed. Reto M. Hilty and Kung-Chung Liu (Berlin: Springer, 2015), 67.

<sup>116</sup> See “Harmonisation of Trips-Plus Ipr Policies and Potential Impacts on Technological Capability: A Case Study of the Pharmaceutical Industry in Thailand,” in *ICTSD Programme on IPRs and Sustainable Development* (2006), 44.



the United States Trade Representative, responding to the firms' concerns, pressed Thailand to adopt additional shields, such as extensions of the patent terms to offset delays in the processing of applications, recognition of the patentability of biological processes and genes, and data exclusivity protections.<sup>117</sup> The initiative might well have succeeded were it not for a 2006 coup in Thailand, which forced a halt to the negotiations. The net result is that the reforms sought by the firms and the USTR were never adopted and the Thai patent regime remains, in their eyes, imperfect.

Among its imperfections is the amount of time it takes the Thai patent office (the Department of Intellectual Property or "DIP") to process applications. Reportedly, the average delay between the date of the application for a patent on a drug and the date on which it issues is 12 years. That is substantially longer than the typical duration in the United States, Europe, or Japan.<sup>118</sup> This may simply be due to insufficient staffing. Alternatively, it may reflect the time required to implement an unusual step in the Thai process for examining applications: the solicitation of public comments with respect to whether the technology in question satisfies the "inventive step" requirement.

Other aspects of the system, however, mitigate its slow pace. Reportedly, firms with pending patent applications have been able to discourage generic firms from entering into competition with them by threatening to litigate as soon as the patents issue. And the DIP has recently announced an innovative way of reducing the backlog: a pilot project in collaboration with the Japanese Patent Office, called the "JPO-DIP Patent Prosecution Highway." Participants in this program will be able to submit patent applications to both of the national patent offices, but designate one of them as the primary reviewer. Decisions by that first office will then be submitted to the second. Although the public description of the program does not indicate that the second office must follow the ruling by the first, it seems likely that the DIP would follow the lead of the JPO. If this does indeed occur, then the program may well achieve its stated objective of "accelerat[ing] the patent application consideration."<sup>119</sup>

In sum, from the standpoint of foreign pharmaceutical firms, the Thai patent regime is not ideal, but it is working. Thousands of patents on pharmaceutical products have already been granted, and more are in the offing. This has enabled the firms to sell their products in Thailand for high prices – and the revenues generated thereby are at least potential sources of support for research and development. On the other hand, the facts that the large majority of the patents have been issued to foreign firms, not Thai firms, and that very little of the research arguably tied to the patent system is conducted in Thailand

---

<sup>117</sup> See *ibid.*, 15-18.

<sup>118</sup> One of the effects of the delay is to produce a large backlog of applications. As of 2016, there were roughly 8000 pending applications, of which roughly one third were for pharmaceutical products. See "Thailand: Evergreened Patents Cause Unwarranted High Drug Prices," Make Medicines Affordable, May 8, 2018, <http://makemedicinesaffordable.org/en/thailand-evergreened-patents-cause-unwarranted-high-drug-prices/>.

<sup>119</sup> See "JPO-DIP Patent Prosecution Highway," <https://www.ipthailand.go.th/en/คู่มือ-คำแนะนำ-ขั้นตอน-สิทธิบัตร/item/การขอให้กรมทรัพย์สินทางปัญญาใช้ผลการตรวจสอบการประดิษฐ์ของสำนักสิทธิบัตรญี่ปุ่นเพื่อประกอบการพิจารณา.html>.

are troubling.<sup>120</sup> Putting aside, for the moment, the adverse impact on employment and training within Thailand, the bias reduces the likelihood that the research will be aimed at diseases endemic in Thailand or other developing countries.

Thus far, Thailand is alone among the five countries in deploying a significant patent system to augment incentives for pharmaceutical research and development. There is, however, one form of support for R&D that all five countries provide: they permit clinical trials to be conducted using their residents. For at least some of the countries, the numbers are large. As of October 2022, the US database of clinical trials lists 294 that have been (or are being) conducted in Malawi, 5 in Namibia, 116 in Cambodia, 62 in Bolivia, and 3,226 in Thailand.<sup>121</sup> The registry maintained by the WHO lists 492 that have been (or are being) conducted in Malawi, 30 in Namibia, 175 in Cambodia, 94 in Bolivia, and a remarkable 10,549 in Thailand.<sup>122</sup>

This is part of a larger trend. During the past few decades, the percentage of clinical trials that are conducted in poor countries has been steadily increasing – in part because they enable the firms to save money.<sup>123</sup> One study reported that “Regional cost savings were greatest in four ... regions: Africa, with the regional cost per site estimated to be a median of 49% of North America, Central Europe 50%, Middle East 53%, and Latin America 59%.”<sup>124</sup>

One might expect that, in return for permitting clinical trials to be conducted using their residents, LMIC governments would at least gain access to the drugs being tested if they prove safe and efficacious. On the contrary. Firms frequently do not even apply for marketing approval in the LMICs in which they run trials.<sup>125</sup> A recent study of the fates of all of the novel drugs approved by the FDA in 2012 and 2014 provides troubling confirmation of this generalization.<sup>126</sup> As is evident from the following figure, most of the drugs that had been subject to clinical trials in middle-income countries had not received marketing approval in those countries even five years after they had been approved by the FDA.

---

<sup>120</sup> See Kuanpoth, "Harmonisation of Trips-Plus Ipr Policies and Potential Impacts on Technological Capability: A Case Study of the Pharmaceutical Industry in Thailand," 41-45.

<sup>121</sup> See <https://clinicaltrials.gov> (last visited October 28, 2022).

<sup>122</sup> See <http://apps.who.int/trialsearch/ListBy.aspx?TypeListing=1> (last visited October 28, 2022).

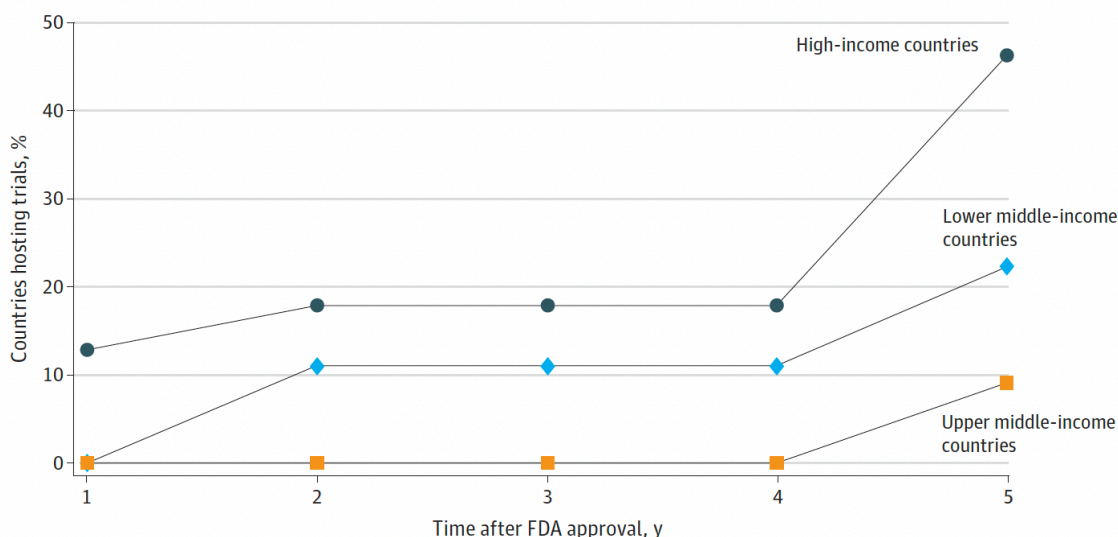
<sup>123</sup> See Seth W. Glickman et al., "Ethical and Scientific Implications of the Globalization of Clinical Research," *New England Journal of Medicine* 360 (2009).

<sup>124</sup> Yao Qiao, G Caleb Alexander, and Thomas J Moore, "Globalization of Clinical Trials: Variation in Estimated Regional Costs of Pivotal Trials, 2015–2016," *Clinical Trials* 16, no. 3 (2019): 331.

<sup>125</sup> See Nria Homedes and Antonio Ugalde, "Availability and Affordability of New Medicines in Latin American Countries Where Pivotal Clinical Trials Were Conducted," *Bulletin of the World Health Organization* 93 (2015).

<sup>126</sup> Jennifer E. Miller et al., "Evaluation of Drug Trials in High-, Middle-, and Low-Income Countries and Local Commercial Availability of Newly Approved Drugs," *JAMA Network Open* 4, no. 5 (2021).

Figure 2. Percentage of Countries Hosting Trials for US Food and Drug Administration (FDA) Drug Approvals That Received Marketing Approval for Those Drugs Within 5 Years, by Income Level



The imperfections of the regulatory approvals processes in those countries (to which we will turn shortly) may explain a few of those instances, but the large majority resulted from the firms' decisions either to delay submitting applications for marketing approval or not to apply at all.

In sum, all five of the countries we are considering provide crucial support for pharmaceutical innovation by permitting new drugs to be tested on their own populations – but frequently are not subsequently able to access those drugs on any terms.

### *Quality*

As indicated above, governmental regulation of drug quality has two main dimensions: (a) determining which medicines may be lawfully marketed; and (b) preventing the sale and consumption of medicines that fail quality-control standards. On paper, all five of the countries we are examining appears to be well positioned with respect to both dimensions.

In each country, a statute and an accompanying set of regulations creates a National Medicines Regulatory Authority (NMRA) and requires its approval before a medicine can be marketed. Those agencies are: the Pharmacy, Medicines and Poisons Board of Malawi;<sup>127</sup> the Namibia Medicines Regulatory Council;<sup>128</sup> the Cambodian Department of

<sup>127</sup> See Margareth Ndomondo-Sigonda et al., "Medicines Regulation in Africa: Current State and Opportunities," *Pharm Med* 31 (2017). The complete list of medicines registered in Malawi is available at [http://www.pmpb.mw/wp-content/uploads/2017/01/All-Registered-Products-30\\_06\\_17.pdf](http://www.pmpb.mw/wp-content/uploads/2017/01/All-Registered-Products-30_06_17.pdf).

<sup>128</sup> <http://www.nmrc.com.na>. For a description of the Council's powers and activities, see Fitch Solutions, "Namibia Pharmaceuticals & Healthcare Report," (2018), 20.

Drugs and Food;<sup>129</sup> the Bureau of Drug Control in Thailand;<sup>130</sup> and Unidad de Medicamentos y Tecnologia en Salud in Bolivia.

As one might expect, none of these agencies has resources or expertise comparable to the FDA or the EMA. Partly as a result, drug approvals in all five countries typically take substantially longer than in the United States or Europe.<sup>131</sup> The adverse impact on patient welfare is obvious.

The situation is even more grim with respect to the second of the two dimensions of quality control: preventing the distribution and consumption of substandard medicines. Although all five of the NMRAs have the authority to conduct post-marketing surveillance and to remove nonconforming medicines from the market, in practice none has the resources to do so effectively. Their staffs of inspectors are small, and none of the countries contains a WHO-certified laboratory capable of reliably subjecting drug samples to HPLC testing. This is especially problematic because, as indicated above, most drugs distributed in all five countries are manufactured by companies located in India or China (or Brazil), over whose plants the NMRAs have no control.

The hazards posed by unscrupulous manufacturers and importers are exacerbated by the imperfections in the distribution chains, mentioned above. In Cambodia, for example, both distributors of pharmaceutical products and pharmacies routinely ignore manufacturers' specifications of the temperatures at which specific products must be transported and stored.<sup>132</sup> In our own work in Malawi, we encountered similar practices. The result: With distressing frequency, even properly manufactured drugs degrade by the time they reach patients. For example, during a random sampling of cancer drugs at a major public hospital in Malawi, we found that, while the pills contained in boxes that had been located in the interior of a large package conformed to quality standards, pills contained in boxes that had been located on the outside edges of the package did not. The most likely reason is that the package had been exposed to sunlight or heat for a sustained period.

The net result: the percentage of medicines that are either falsified or substandard is high. Exactly how high the rate is in each country is uncertain. As explained in the Introduction, the percentage in the developing world as a whole is over 10%. Empirical studies in the five countries on which we are concentrating suggest that, in all of them, the situation is at least as bad as in other LMICs. In Malawi, one study found that 88.4% of the anti-malarial drugs tested either had too little (less than 90%) or too much (more than

---

<sup>129</sup> <https://www.ddfcambodia.com>

<sup>130</sup> [https://www.fda.moph.go.th/sites/fda\\_en/SitePages/Drug.aspx?IDitem=LawsAndRegulations](https://www.fda.moph.go.th/sites/fda_en/SitePages/Drug.aspx?IDitem=LawsAndRegulations).

<sup>131</sup> See, e.g., Vincent Ahonkhai et al., "Speeding Access to Vaccines and Medicines in Low- and Middle-Income Countries: A Case for Change and a Framework for Optimized Product Market Authorization," *PLoS ONE* 11, no. 11 (2016); Carlos E. Durán et al., "Regulatory Reliance to Approve New Medicinal Products in Latin American and Caribbean Countries," *Rev Panam Salud Publica* 45 (2021), <https://www.scielosp.org/pdf/rpsp/2021.v45/e10/en>. (Bolivia had declined to rely during its approval processes upon marketing-approval decisions in other jurisdiction);

<sup>132</sup> See Laurent Pordié, "Unstable Pharmaceutical Values: The Grey Political Economy of Drug Circulation in Cambodia," *BioSocieties* 16 (2021).

110%) of the active ingredients they purported to contain.<sup>133</sup> Another found that 45.5% of a random sample of co-trimoxazole (a common antibiotic) failed quality-control standards.<sup>134</sup> The one study published to date of the situation in Namibia reported that 13.9% of the medicines sampled “did not conform to pharmacopoeial specifications.”<sup>135</sup> Of the four countries, Cambodia has received the most systematic attention, in part because the Cambodian Ministry of Health has striven to combat falsified and substandard drugs. Unfortunately, despite the Ministry’s efforts, all studies to date have reported the persistence of high rates of poor-quality drugs.<sup>136</sup> By contrast, the one published study on Bolivia is encouraging: the percentage of antimalarial drugs tested between 2006 and 2009 that failed quality controls was modest.<sup>137</sup> However, in recent years a series of scandals in Bolivia involving the importation or distribution of deliberately falsified drugs suggests that the incidence remains high.<sup>138</sup> Studies of the incidence in Thailand have identified an equally serious problem.<sup>139</sup> In sum, in all five nations, the nature of the drug distribution system and the limited capacities of the regulatory authorities have contributed to a high rate of poor-quality drugs.

---

<sup>133</sup> See Chikowe, I, Osei-Safo, D, Harrison, JJEK, et al. Post-marketing surveillance of anti-malarial medicines used in Malawi. 2015; *Malaria Journal*, 14:127. Cf. Khuluza, F, et al. (2016) “Use of thin-layer chromatography to detect counterfeit sulfadoxine/pyrimethamine tablets with the wrong active ingredient in Malawi,” *Malaria Journal*, 15:215 (a pilot study assessing the efficacy of testing methods found one falsified and one substandard batch out of a sample of 28 batches of a common anti-malarial drug).

<sup>134</sup> Khuluza, F (2014) “In-vitro evaluation of the quality of Paracetamol and Co-trimoxazole tablets used in Malawi based on pharmacopoeial standards,” *Malawi Medical Journal*, 26(2):38:41.

<sup>135</sup> See Nasser Mbaziira, “Registration and Quality Assurance of Arvs and Other Essential Medicines in Namibia,” (USAID, 2015).

<sup>136</sup> See Daravuth Yang et al., “Quality of Pharmaceutical Items Available from Drugstores in Phnom Penh, Cambodia,” *SOUTHEAST ASIAN J TROP MED PUBLIC HEALTH* 35, no. 3 (2004).(only 7.3% of 96 samples of aspirin “satisfied all six quality criteria); C.T. Lona, S. Phanouvongc R. Tsuyuokab, N. Nivannad, D. Socheata,, and N. Blumc C. Sokhane, E.M. Christophelf, A. Sminec, “Counterfeit and Substandard Antimalarial Drugs in Cambodia,” *Transactions of the Royal Society of Tropical Medicine and Hygiene* 100 (2006).(27% of sampled antimalarials failed quality tests); Mohiuddin Hussain Khan et al., “Prevalence of Counterfeit Anthelmintic Medicines: A Cross-Sectional Survey in Cambodia,” *Tropical Medicine and International Health* 15, no. 5 (2010).(4.2% of sampled anhelminthic medicines confirmed to be counterfeit); Naoko Yoshida et al., “A Cross-Sectional Investigation of the Quality of Selected Medicines in Cambodia in 2010,” *BMC Pharmacology and Toxicology* 15, no. 13 (2014): 4.(14.5% of 325 sampled drugs were of “unacceptable quality”); Shunmay Yeung et al., “Quality of Antimalarials at the Epicenter of Antimalarial Drug Resistance: Results from an Overt and Mystery Client Survey in Cambodia,” *American Journal of Tropical Medical Hygiene* 92, no. 6 (2015): 44. (thorough study finding that 31.5% of sampled antimalarials contained either less than 85% or more than 115% of the stated API);

<sup>137</sup> See Victor S Pribluda et al., “Implementation of Basic Quality Control Tests for Malaria Medicines in Amazon Basin Countries: Results for the 2005–2010 Period,” *Malaria Journal* 11 (2012): 5.

<sup>138</sup> See, e.g., “Bolivia: Pharmaceutical Company Presses Charges Against Suspected Falsified Medicine Trafficker” (September 8, 2017), <https://www.iracm.com/en/2017/09/bolivia-pharmaceutical-company-presses-charges-suspected-falsified-medicine-trafficker/>; “Bolivia: Three Arrested in Santa Cruz for Selling Fake Medicines” (April 29, 2019), <https://www.iracm.com/en/2019/04/bolivia-three-arrested-santa-cruz-selling-fake-medicines/>; Marv Shepard, “Black Medicine: The Exploding International Trade in Counterfeit Medicine,” *Americas Quarterly*, Summer 2010, <https://www.americasquarterly.org/node/1698>.

<sup>139</sup> See, e.g., International Institute of Research Against Counterfeit Medicines, “Medicine Falsification in Southeast Asia,” <https://www.iracm.com/en/2018/05/medicine-falsification-south-east-asia/>; “Countering Counterfeit Medicines in the Fast-Paced World of E-Commerce.”

## *Access*

As we saw, the primary technique employed by the government of the United States to increase residents' access to medicines consists of subsidies (direct and indirect) for health insurance policies that provide at least partial coverage for medicines. By contrast, the primary technique employed by most European countries is regulation of drug prices.

Neither of these techniques is employed to a significant extent by any of the five developing countries we are considering. As previously noted, private health insurance is available in some of the countries, but the proportions of the populations who subscribe are much lower than in the United States, and the governments do not subsidize the policies.<sup>140</sup> And none of the five countries limits the prices at which drugs may be sold in the private market.<sup>141</sup>

Instead, all five countries rely heavily on procurement to increase their residents' access to medicines. The Health ministries in all five formulate lists of "essential medicines" and then buy large quantities of those medicines -- typically from generic manufacturers, most of them located in either India or China.<sup>142</sup> The ministries then distribute those drugs, for free or at very low prices, to the people who need them.<sup>143</sup> This approach is made possible by large subsidies the ministries receive, directly or indirectly, from the governments of other nations or from NGOs.

An unintended but important advantage of this strategy is that it exerts downward pressure on the prices of drugs sold outside the public sector of the healthcare system. In Malawi, for example, a significant proportion of medicines (somewhere between 10% and 30%) are distributed by nongovernmental pharmacies, clinics, and hospitals. The government does not regulate the prices they charge, but the fact that most of the drugs are available for free in the public sector keeps prices in the private sector at affordable levels.<sup>144</sup>

In addition, Thailand employs another technique for increasing access. As indicated above, Thailand is alone among the five countries in having a robust patent system for pharmaceutical products. It is also alone, however, in being willing to impose compulsory licenses on patentees when necessary to ensure its residents' access to the drugs at issue. This technique will figure significantly in our discussion (in Chapter 4) of the policy options currently open to LMICs, so Thailand's usage of it merits discussion in detail.

---

<sup>140</sup> See McCabe et al., "Pharmaceutical Supply in Africa," 12.

<sup>141</sup> *Ibid.*, 12, 15.

<sup>142</sup> See, e.g., Pordié, "Unstable Pharmaceutical Values: The Grey Political Economy of Drug Circulation in Cambodia." A partial exception is Thailand, where the GPO can and does manufacture many of the drugs itself.

<sup>143</sup> McCabe et al., "Pharmaceutical Supply in Africa," 12.

<sup>144</sup> *Ibid.*

First, some background: Article 31 of the TRIPS Agreement (which, as we have seen, binds all member countries of the World Trade Organization) imposes significant limitations on countries' ability to force patentees to license other parties to use patented technologies. For least-developed countries (such as Malawi and Cambodia), who will not be obliged to extend patent protection to pharmaceutical products until 2033, Article 31 for the time being is unimportant. But it limits the ability of all other members of the WTO to temper patents in the interest of public health. Between 1995 and 2001, the ambiguity of many of the terms in Article 31, combined with restrictive interpretations of those terms by the United States, discouraged almost all developing countries from employing compulsory licenses. Protests and controversies arising out of the resultant impairment of public access to crucial medicines (exemplified by the inability of South African AIDS victims to afford ARVs) eventually forced the WTO to revisit the issue. The outcome was the 2001 Declaration on the TRIPS Agreement and Public Health, commonly known as the "Doha Declaration."<sup>145</sup> The key provision of the Declaration was Article 5, which recognizes that each WTO Member (i) has the right to grant compulsory licenses and the freedom to determine the grounds upon which such licenses are granted, (ii) has the right to determine what constitutes a national emergency or other circumstances of extreme urgency, and (iii) is free to establish its own patent exhaustion regime (and thus to allow parallel imports – a topic to which we will return in Chapter 4).

The Doha Declaration also recognized that WTO Members with limited pharmaceutical manufacturing capacities could face difficulties in making effective use of compulsory licenses. Article 6 instructed the Council for TRIPS to find an "expeditious solution" to this problem. A long and contentious series of negotiations ensued, eventuating in an awkward compromise. In brief, the WTO Decision of August 30, 2003 permits a compulsory license to be used to supply drugs to another country experiencing health emergencies (the definition of which was intentionally left vague) and relieves the importing country of the duty to pay the patentee adequate remuneration, but imposes on the importing country a duty to adopt "reasonable measures within [its] means" to prevent diversion of the drugs to more lucrative markets.<sup>146</sup>

In November of 2006, soon after the collapse of the negotiations over a free trade agreement, the new military government of Thailand decided to invoke its authority under sections 51 and 52 of the Thai patent statute,<sup>147</sup> which it believed complied with the Doha

---

<sup>145</sup> WT/MIN(01)/DEC/2 (November 20, 2001). The name comes from the fact that it was adopted at the end of the Fourth Ministerial Conference of the World Trade Organization, held in Doha, Qatar in November 2001. Formally, the Declaration has interpretive force as "subsequent practice" in the application of TRIPS in the sense of Article 31(3)(b) of the Vienna Convention on the Law of Treaties. For additional detail concerning the declaration and its background, see William Fisher and Cyril Rigamonti, "The South Africa AIDS Controversy: A Case Study in Patent Law and Policy" (2005), <https://cyber.harvard.edu/people/ffisher/South%20Africa.pdf>.

<sup>146</sup> See WT/L/540 (September 2, 2003), available at [https://docs.wto.org/dol2fe/Pages/FE\\_Search/FE\\_S\\_S009-DP.aspx?language=E&CatalogueIdList=51809,2548,53071,70701&CurrentCatalogueIdIndex=1&FullTextHash=&HasEnglishRecord=True&HasFrenchRecord=True&HasSpanishRecord=True..](https://docs.wto.org/dol2fe/Pages/FE_Search/FE_S_S009-DP.aspx?language=E&CatalogueIdList=51809,2548,53071,70701&CurrentCatalogueIdIndex=1&FullTextHash=&HasEnglishRecord=True&HasFrenchRecord=True&HasSpanishRecord=True..)

<sup>147</sup> Article 51 provides: "In order to carry out any service for public consumption or which is of vital importance to the defense of the country or for the preservation or realization of natural resources or the environment or to prevent or relieve a severe shortage of food, drugs or other consumption items or for any

Declaration. In rapid succession, the government issued compulsory licenses on the patents on three drugs: efavirenz, a HIV drug distributed by Merck; lopinavir/ritonavir (also known as Kaletra), an HIV drug distributed by Abbott Laboratories; and clopidogrel (also known as Plavix), a popular anti-clotting drug distributed by Sanofi-Aventis and Bristol-Meyers-Squibb. Relying on these licenses, the GPO initially imported generic versions of the drugs from India and then began manufacturing generic versions itself. The sharply lower cost of the generics in turn enabled the government to provide drugs to large sets of people in the public health sector.<sup>148</sup>

Both the affected firms and the government of the United States responded harshly. In their view, these compulsory licenses were illegitimate for several reasons: they were issued without adequate prior consultation; they provided the patentees insufficient remuneration; and some did not involve true health emergencies. The USTR retaliated by placing Thailand on the Section 301 “Priority Watch List” and threatening to revoke some of Thailand’s trade privileges. Abbott sought to punish the Thai government by withdrawing all of Abbott’s patented drugs from the Thai market. However, the government held firm, and indeed soon announced additional compulsory licenses on four cancer drugs.<sup>149</sup> In the end, most of the firms retreated, agreeing to sell the drugs in question at much lower prices, and the controversy subsided. Thereafter, the government was in a much stronger position when negotiating purchases of patented medicines.<sup>150</sup>

There is little doubt that, at least in the short run, the seven compulsory licenses imposed by the Thai government had substantial health benefits. One study concluded that they resulted, within a five-year period, in “12,493 QALYs gained, which translates into quantifiable incremental benefits to society of USD132.4 million.”<sup>151</sup> A hard question is

---

other public service, any ministry, bureau or department of the Government may, by themselves or through others, exercise any right under Section 36 by paying a royalty to the patentee or his exclusive licensee under paragraph 2 of Section 48 and shall notify the patentee in writing without delay, notwithstanding the provisions of Sections 46, 46bis and 47. In the circumstances under the above paragraph, the ministry or bureau or department shall submit its offer setting forth the amount of remuneration and conditions for the exploitation to the Director-General. The royalty rate shall be as agreed upon by the ministry or bureau or department and the patentee or his licensee, and the provisions of Section 50 shall apply *mutatis mutandis*.”

Article 52 provides: “During a state of war or emergency, the Prime Minister, with the approval of the Cabinet, shall have the power to issue an order to exercise any right under any patent necessary for the defense and security of the country by paying a fair remuneration to the patentee and shall notify the patentee in writing without delay.”

Patent Act B.E. 2522 (1979) As Amended by the Patent Act (No. 2) B.E 2535 (1992) and the Patent Act (No. 3) B.E. 2542 (1999), available at <https://www.wipo.int/edocs/lexdocs/laws/en/th/th007en.html>.

<sup>148</sup> See Kuanpoth, "Compulsory Licences in Thailand."; "Thailand Issues Compulsory Licence for Patented Aids Drug," *Bridges* 10, no. 42 (2006), <https://www.ictsd.org/bridges-news/bridges/news/thailand-issues-compulsory-licence-for-patented-aids-drug>.

<sup>149</sup> See Siraprapha Rungpry and Edward J Kelly, "Compulsory Licensing Developments in Thailand," *IP Review* (2008).

<sup>150</sup> See Thomas Fuller, "Thailand Takes on Drug Industry, and May Be Winning," *New York Times*, April 11, 2007.

<sup>151</sup> See Inthira Yamabhai et al., "Government Use Licenses in Thailand: An Assessment of the Health and Economic Impacts," *Globalization and Health* 7, no. 28 (2011).



whether such compulsory licenses are the best of the policy options available to LMICs. In Part II of this book, we will attempt to answer it.

## References

- “National Academies of Sciences, Engineering, and Medicine”. "Making Medicines Affordable: A National Imperative." edited by The National Academies Press. Washington, DC, 2018.
- A.DiMasi, Joseph, Henry G.Grabowski, and Ronald W.Hansen. "Innovation in the Pharmaceutical Industry: New Estimates of R&D Costs." *Journal of Health Economics* 47 (2016): 20-33.
- Aaronson, Jeffrey K., and A. Richard Green. "Me-Too Pharmaceutical Products: History, Definitions, Examples, and Relevance to Drug Shortages and Essential Medicines Lists." *British Journal of Clinical Pharmacology* 86 (2020): 2114-22.
- Adams, Christopher P. and Brantner, Van V. "Estimating the Cost of New Drug Development: Is It Really \$802 Millin?". *Health Affairs* 25, no. 2 (March/April 2006 2006): 9.
- Administration, Food and Drug. "Advancing Health through Innovation: New Drug Therapy Approvals 2019." 2020.
- Ahonkhai, Vincent, Samuel F. Martins, Alexandre Portet, Murray Lumpkin, and Dan Hartman. "Speeding Access to Vaccines and Medicines in Low- and Middle-Income Countries: A Case for Change and a Framework for Optimized Product Market Authorization." *PLoS ONE* 11, no. 11 (2016).
- Angell, Marcia. *The Truth About the Drug Companies: How They Deceive Us and What to Do About It*. New York: Random House, 2004.
- Arjen M. Dondorp, François Nosten, Poravuth Yi, and M.D. Debashish Das, Aung Phae Phyo, M.D., Joel Tarning, Ph.D., Khin Maung Lwin, M.D., Frederic Ariey, M.D., Warunee Hanpithakpong, Ph.D., Sue J. Lee, Ph.D., Pascal Ringwald, M.D., Kamolrat Silamut, Ph.D. "Artemisinin Resistance in Plasmodium Falciparum Malaria." *New England Journal of Medicine* 361 (2009): 455-67.
- Ayres, Ian, and Lisa Larrimore Ouellette. "A Market Test for Bayh-Dole Patents." *Cornell Law Review* 102 (2017).
- Benkler, Yochai. "Coase's Penguin, or, Linux and the Nature of the Firm." *Yale L. J.* 112 (2002).
- . *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven: Yale University Press, 2006.
- Berndt, Ernst R., and Joseph P. Newhouse. "Pricing and Reimbursement in U.S. Pharmaceutical Markets." In *Oxford Handbook on the Economics of the Pharmaceutical Industry*, edited by Patricia M. Danzon and Sean Nicholson: Oxford University Press, 2012.

- Breyer, Stephen. "The Uneasy Case for Copyright: A Study of Copyright in Books, Photocopies, and Computer Programs." *Harvard Law Review* 84 (1970): 281.
- Brockmeyer, Benedikt. "The Health System in Namibia: Deliberations About an Affordable National Health Insurance for the Low-Income Workforce in Namibia." 2012.
- Bruun, Henriette, and Beth Elverdam. "Los Naturistas—Healers Who Integrate Traditional and Biomedical Explanations in Their Treatment in the Bolivian Health Care System." *Anthropology & Medicine* 13, no. 3 (2006): 273-83.
- C.T. Lona, S. Phanouvongc R. Tsuyuokab, N. Nivannad, D. Socheata,, and N. Blumc C. Sokhane, E.M. Christophelf, A. Sminec. "Counterfeit and Substandard Antimalarial Drugs in Cambodia." *Transactions of the Royal Society of Tropical Medicine and Hygiene* 100 (2006): 1019-24.
- Calfee, John E., and Scott Gottlieb. "Putting Markets to Work in Vaccine Manufacturing." *American Enterprise Institute for Public Policy Research* (2004 2004).
- Carpenter, Daniel. *Reputation and Power: Organizational Image and Pharmaceutical Regulation at the Fda*. Princeton: Princeton University Press, 2010.
- Carver, Krista Hessler, Jeffrey Elikan, and Erika Lietzan. "An Unofficial Legislative History of the Biologics Price Competition and Innovation Act of 2009." *Food and Drug Law Journal* 65 (2010).
- Cockburn, Iain M. and Henderson, Rebecca. "Scale and Scope in Drug Development: Unpacking the Advantage of Size in Pharmaceutical Research." *Journal of Health Economics* 20, no. 6 (November 2001 2001): 1033-57.
- Cohen, Erik. "Medical Tourism in Thailand." *AU-GSB e-Journal* 1, no. 1 (2008).
- "Countering Counterfeit Medicines in the Fast-Paced World of E-Commerce."
- Danzon, Patricia, ed. *Price Comparisons for Pharmaceuticals: A Review of U.S. And Cross-National Studies*, 1999.
- Danzon, Patricia, and Michael Furukawa. "Competition in Generic Pharmaceutical Markets: Cross-National Evidence." In *Petrie-Flom Drugs Conference*, 2009.
- Daravuth Yang, Pinyupa Plianbangchang, Nuwat Visavarungroj, and Soravoot Rujivipat1. "Quality of Pharmaceutical Items Available from Drugstores in Phnom Penh, Cambodia." *SOUTHEAST ASIAN J TROP MED PUBLIC HEALTH* 35, no. 3 (2004): 741-47.
- Darrow, Jonathan J., Michael S. Sinha, and Aaron S. Kesselheim. "When Markets Fail: Patents and Infectious Disease Products." *Food and Drug Law Journal* 73 (2018).

- DiMasi, Joseph A. "Comment on "Me-Too Drugs: Is There a Problem?"" (2005). <https://www.who.int/intellectualproperty/forum/HollisResponse.pdf>.
- DiMasi, Joseph A., and Cherie Paquette. "The Economics of Follow-on Drug Research and Innovation: Trends in Entry Rates and the Timing of Development." *Pharmacoeconomics* 22 (2004): 1-14.
- Dugan, Mark, and Fiona Scott Morton. "The Distortionary Effects of Government Procurement: Evidence from Medicaid Prescription Drug Purchasing." *Quarterly Journal of Economics* 71, no. 1 (2006): 4.
- Durán, Carlos E., Martín Cañas, Martín A. Urtasun, Tatiana Andia Monique Elseviers, 3, and 1 and Thierry Christiaens, Robert Vander Stichele. "Regulatory Reliance to Approve New Medicinal Products in Latin American and Caribbean Countries." *Rev Panam Salud Publica* 45(2021): e10. <https://www.scielosp.org/pdf/rpsp/2021.v45/e10/en>.
- Eisenberg, Rebecca S. "The Role of the Fda in Innovation Policy." *Michigan Telecommunications & Technology Law Review* 13 (2007): 345.
- Emily Fisher, Rebecca Lazarus, and Ramin Asgary. "Attitudes and Perceptions Towards Access and Use of the Formal Healthcare Sector in Northern Malawi." *Journal of Health Care for the Poor and Underserved* 28, no. 3 (2017): 1104-15.
- Eyal-Cohen, Mirit, and Ana Santos Rutschman. "Tax Policy and Pharmaceutical Innovation." (forthcoming) (2020).
- Fegraus, Laura, and Murray Ross. "Sovaldi, Harvoni, and Why It's Different This Time." *Health Affairs* (2014). Published electronically November 21, 2014. <https://www.healthaffairs.org/doi/10.1377/hblog20141121.042908/full/>.
- Finkelstein. "Static and Dynamic Effects of Health Policy: Evidence from the Vaccine Industry." [In ]. *Quarterly Journal of Economics* (2004).
- Fisher, William W., III. *Promises to Keep: Technology, Law, and the Future of Entertainment* Stanford University Press, 2004.
- Fuller, Thomas. "Thailand Takes on Drug Industry, and May Be Winning." *New York Times*, April 11, 2007.
- Glickman, Seth W., John G. McHutchison, Eric D. Peterson, and M.D. Charles B. Cairns, Robert A. Harrington, M.D., Robert M. Califf, M.D., and Kevin A. Schulman, M.D. "Ethical and Scientific Implications of the Globalization of Clinical Research." *New England Journal of Medicine* 360 (2009): 816-23.
- Golden, John M. "Biotechnology, Technology Policy, and Patentability: Natural Products and Invention in the American System." *Emory Law Journal* 50 (2001): 101-91.

- Grabowski, Henry, and John M. Vernon. *The Regulation of Pharmaceuticals: Balancing the Benefits and Risks*. 1983.
- Hatswell, Anthony J., Gianluca Baio, Jesse A. Berlin, Alar Irs, and Nick Freemantle. "Regulatory Approval of Pharmaceuticals without a Randomised Controlled Study: Analysis of Ema and Fda Approvals, 1999–2014." *BMJ Open* 6 (2016).
- Hollis, Aidan. "Me-Too Drugs: Is There a Problem?" (2004). [https://www.who.int/intellectualproperty/topics/ip/Me-tooDrugs\\_Hollis1.pdf](https://www.who.int/intellectualproperty/topics/ip/Me-tooDrugs_Hollis1.pdf).
- Homedes, Núria, and Antonio Ugalde. "Availability and Affordability of New Medicines in Latin American Countries Where Pivotal Clinical Trials Were Conducted." *Bulletin of the World Health Organization* 93 (2015): 674-83.
- Howie, Lynn J., Bradford R. Hirsh, and Amy Abernathy. "A Comparison of Fda and Ema Drug Approval: Implications for Drug Development and Cost of Care." *Oncology* 27, no. 12 (2013). <https://www.cancernetwork.com/oncology-journal/comparison-fda-and-ema-drug-approval-implications-drug-development-and-cost-care>.
- Ina Vandebroek, Evert Thomas, Sabino Sanca, Luc Patrick Van Damme<sup>2</sup>, and Van Puyvelde<sup>4</sup> and Norbert De Kimpe<sup>5</sup>. "Comparison of Health Conditions Treated with Traditional and Biomedical Health Care in a Quechua Community in Rural Bolivia." *Journal of Ethnobiology and Ethnomedicine* 4, no. 1 (2008).
- "Interview: Nares Damrongchai – Ceo, Thailand Center of Excellence for Life Sciences (Tcels)." *Pharma Boardroom*, August 24, 2015.
- Inthira Yamabhai, Adun Mohara, Sripen Tantivess, and Kakanang Chaisiri and Yot Teerawattananon. "Government Use Licenses in Thailand: An Assessment of the Health and Economic Impacts." *Globalization and Health* 7, no. 28 (2011).
- Jankovic, Slobodan M. "Comparison of Ema and Fda Guidelines for Drug Interactions: An Overview." *Clinical Research and Regulatory Affairs* 31, no. 2-4 (2014): 29-34.
- Joshua Cohen, Catherine Cairns, Cherie Paquette, and Laura Faden. "Comparing Patient Access to Pharmaceuticals in the Uk and Us." *Appl Health Econ Health Policy* 5, no. 3 (2006): 177-87.
- Kapczynski, Amy. "Order without Intellectual Property Law: Open Science in Influenza." *Cornell Law Review* 102 (2017).
- Kashoki, Mwango, Zahra Hanaizi, Stella Yordanova, Christelle Bouygues<sup>3</sup> Richard Vesely<sup>3</sup>, and Jordi Llinars<sup>3</sup> and Sandra L. Kweder<sup>4</sup>. "A Comparison of Ema and Fda Decisions for New Drug Marketing Applications 2014–2016: Concordance, Discordance, and Why." *Clinical Pharmacology & Therapeutics* 107, no. 1 (2020): 195-202.

- Keovathanak, Khim, and Peter Leslie Annear. "The Transition to Semi-Autonomous Management of District Health Services in Cambodia: Assessing Purchasing Arrangements, Transaction Costs, and Operational Efficiencies of Special Operating Agencies." In *Improving Health Sector Performance: Institutions, Motivations and Incentives*, edited by Hossein Jalilian and Vicheth Sen, 2011.
- Kessler, David A., Rose, Janet L, Temple, Robert J., Schapiro, Renie and Griffin, Joseph P. "Therapeutic Class Wars -- Drug Promotion in a Competitive Marketplace." *New England Journal of Medicine* 331, no. 2 (November 17, 1994 1994): 4.
- Khuluza, Felix, and Christine Haefele-Abah. "The Availability, Prices and Affordability of Essential Medicines in Malawi: A Crosssectional Study." *PLoS ONE* 14, no. 2 (2019): e0212125.
- Kiff, Sarah. "The U.S. Commits to Buying Millions of Vaccine Doses. Why That's Unusual." *New York Times*, July 22, 2020 2020.
- Kremer, Michael, and Rachel Glennerster. *Strong Medicine: Creating Incentives for Pharmaceutical Research on Neglected Diseases*. Princeton, N.J.: Princeton University Press, 2004.
- Kuanpoth, Jakkrit. "Compulsory Licences: Law and Practice in Thailand." In *Compulsory Licensing: Practical Experiences and Ways Forward*, edited by Reto M. Hilty and Kung-Chung Liu. Berlin: Springer, 2015.
- . "Harmonisation of Trips-Plus Ipr Policies and Potential Impacts on Technological Capability: A Case Study of the Pharmaceutical Industry in Thailand." In *ICTSD Programme on IPRs and Sustainable Development*, 2006.
- Laakmann, Anna B. "Collapsing the Distinction between Experimentation and Treatment in the Regulation of New Drugs." *Alabama Law Review* 62 (2011 2011): 305.
- Lakdawalla, Darius. "Insurer Bargaining and Negotiated Drug Prices in Medicare Part D\*." In *Petrie-Flom Drugs Conference*, 2009.
- Lemley, Mark, Lisa Larrimore Ouellette, and Rachel Sachs. "The Medicare Innovation Subsidy." *New York University Law Review* 95 (2020).
- Lichtenberg, Frank R., and Gautier Duflos. "The Effect of Patent Expiration on U.S. Drug Prices, Marketing, and Utilization by the Public." *Manhattan Institute for Policy Research* (2009). [http://www.manhattan-institute.org/html/mpr\\_11.htm](http://www.manhattan-institute.org/html/mpr_11.htm).
- Londono, Ernesto. "Bolivian Leader Evo Morales Steps Down." *New York Times*, November 13, 2019 2019.
- Ly, Sopheap. "Social Health Insurance in Cambodia: An Analysis of the Health Care Delivery Mechanism." In *Improving Health Sector Performance: Institutions, Motivations and Incentives*, edited by Hossein Jalilian and Vicheth Sen, 2011.

- Mao, Wenhui, Yunyu Huang, and Wen Chen. "An Analysis on Rational Use and Affordability of Medicine after the Implementation of National Essential Medicines Policy and Zero Mark-up Policy in Hangzhou, China." *PLoS ONE* (2019). Published electronically March 19, 2019. <https://doi.org/10.1371/journal.pone.0213638>.
- Mbaziira, Nasser. "Registration and Quality Assurance of Arvs and Other Essential Medicines in Namibia." USAID, 2015.
- McCabe, Ariane, Andreas Seiter, Assiatou Diack, Christopher H. Herbst, Sheila Dutta, and Karima Saleh. "Private Sector Pharmaceutical Supply and Distribution Channels in Africa: A Focus on Ghana, Malawi and Mali." In *HNP Discussion Paper: World Bank*, 2011.
- Medicines, International Institute of Research Against Counterfeit. "Medicine Falsification in Southeast Asia." Published electronically May 1, 2018. <https://www.iraacm.com/en/2018/05/medicine-falsification-south-east-asia/>.
- Merrill, Richard A. "The Architecture of Government Regulation of Medical Products." *Virginia Law Review* 82 (1996).
- Miller, Jennifer E., Michelle M. Mello, Joshua D. Wallach, BS; Blake Bohlig Emily M. Gudbranson, PA-C; Joseph S. Ross, MD, MHS;, and MD; Peter B. Bach Cary P. Gross, MD. "Evaluation of Drug Trials in High-, Middle-, and Low-Income Countries and Local Commercial Availability of Newly Approved Drugs." *JAMA Network Open* 4, no. 5 (2021).
- Mohiuddin Hussain Khan, Junko Okumura, Nam Nivanna<sup>3</sup> Tey Sovannarith<sup>3</sup>, Manabu Akazawa<sup>1</sup> and, and Kazuko Kimura<sup>1</sup>. "Prevalence of Counterfeit Anthelmintic Medicines: A Cross-Sectional Survey in Cambodia." *Tropical Medicine and International Health* 15, no. 5 (2010): 639-44.
- Morgan, Maxwell R. "Regulation of Innovation under Follow-on Biologics Legislation: Fda Exclusivity as an Efficient Incentive Mechanism." *Columbia Science and Technology Law Review* 11 (2010).
- Naoko Yoshida, Mohiuddin Hussain Khan, Eav Dararath<sup>2</sup> Hitomi Tabata<sup>1</sup>, Tey Sovannarith<sup>3</sup>, Heng Bun Kiet<sup>2</sup>, and Manabu Akazawa<sup>4</sup> Nam Nivanna<sup>3</sup>, Hirohito Tsuboi<sup>1</sup>, Tsuyoshi Tanimoto<sup>5</sup> and Kazuko Kimura<sup>1</sup>. "A Cross-Sectional Investigation of the Quality of Selected Medicines in Cambodia in 2010." *BMC Pharmacology and Toxicology* 15, no. 13 (2014).
- Ndomondo-Sigonda, Margareth, Jacqueline Miot, Shan Naidoo, Alexander Dodoo<sup>4</sup>, and Eliangiringa Kaale<sup>5</sup>. "Medicines Regulation in Africa: Current State and Opportunities." *Pharm Med* 31 (2017): 383-97.
- Office", "Congressional Budget. "Research and Development in the Pharmaceutical Industry." (2006 2006).

- . "Research and Development in the Pharmaceutical Industry." 2021.
- Olson, Mary K. "First Drug Launches in the U.S. And Drug Safety." In *Petrie-Flom Drugs Conference*, 2009.
- Outterson, Kevin. "The Legal Ecology of Resistance: The Role of Antibiotic Resistance in Pharmaceutical Innovation." *Cardozo Law Review* 31 (2010): 613-78.
- Paek, Seung Chun, Natthani Meemon, and Thomas T.H. Wan. "Thailand's Universal Coverage Scheme and Its Impact on Health-Seeking Behavior." *SpringerPlus* 5 (2016): 1952.
- Pocock, Nicola S., and Kai Hong Phua. "Medical Tourism and Policy Implications for Health Systems: A Conceptual Framework from a Comparative Study of Thailand, Singapore and Malaysia." *Globalization and Health* 7, no. 12 (2011).
- Pordié, Laurent. "Unstable Pharmaceutical Values: The Grey Political Economy of Drug Circulation in Cambodia." *BioSocieties* 16 (2021): 342-62.
- Qiao, Yao, G Caleb Alexander, and Thomas J Moore. "Globalization of Clinical Trials: Variation in Estimated Regional Costs of Pivotal Trials, 2015–2016." *Clinical Trials* 16, no. 3 (2019): 329-33.
- Qiu, Lan, Zi-Ya Chen<sup>2</sup>, Deng-Yu Lu<sup>2</sup>, Hao Hu<sup>1\*</sup>, and Yi-Tao Wang<sup>1\*</sup>. "Public Funding and Private Investment for R&D: A Survey in China's Pharmaceutical Industry." *Health Research Policy and Systems* 12, no. 27 (2014).
- Qun Wang, Stephan Brenner, Gerald Leppert, and 2 Olivier Kalmus<sup>1</sup> and Manuela De Allegril Thomas Hastings Banda. "Health Seeking Behaviour and the Related Household out-of-Pocket Expenditure for Chronic Non-Communicable Diseases in Rural Malawi." *Health Policy and Planning* 30 (2015): 242–52.
- Rai, Arti K. "Regulating Scientific Research: Intellectual Property Rights and the Norms of Science." *Northwestern University Law Review* 94 (1999): 77-152.
- Raustiala, Kal, and Chris Sprigman. "The Piracy Paradox Revisited." *Stanford Law Review* (2009).
- Richard J Maude, Wirichada Pontavornpinyo, Sompob Saralamba, Shunmay Yeung<sup>1</sup> Ricardo Aguas<sup>3, 4</sup>, Arjen M Dondorp<sup>1,2</sup>, Nicholas PJ Day<sup>1,2,, and 2</sup> and Lisa J White<sup>1</sup> Nicholas J White<sup>1</sup>. "The Last Man Standing Is the Most Resistant: Eliminating Artemisinin-Resistant Malaria in Cambodia." *Malaria Journal* 8, no. 31 (2009).
- Rory Collins, Christina Reith, Jonathan Emberson, Jane Armitage, Colin Baigent, and Roger Blumenthal Lisa Blackwell, John Danesh, George Davey Smith, David DeMets, Stephen Evans, Malcolm Law, Stephen MacMahon, Seth Martin, Bruce Neal, Neil Poulter, David Preiss, Paul Ridker, Ian Roberts, Anthony Rodgers, Peter



- Sandercock, Kenneth Schulz, Peter Sever, John Simes, Liam Smeeth, Nicholas Wald, Salim Yusuf, Richard Peto. "Interpretation of the Evidence for the Efficacy and Safety of Statin Therapy." *The Lancet* 388 (2016): 2532-61.
- Rottingen, John-Arne, Sadie Regmi, Mari Eide, Alison J. Young, and Roderik F. Viergever. "Mapping of Available Health Research and Development Data: What's There, What's Missing, and What Role Is There for a Global Observatory." *Lancet* 382 (2013): 1286-307.
- Rungpry, Siraprapha, and Edward J Kelly. "Compulsory Licensing Developments in Thailand." *IP Review* (2008).
- Scherer, F.M. "The Economics of Parallel Trade in Pharmaceutical Products." (2001). [http://www.wto.org/english/tratop\\_e/trips\\_e/hosbjor\\_presentations\\_e/13scherer\\_e.doc](http://www.wto.org/english/tratop_e/trips_e/hosbjor_presentations_e/13scherer_e.doc).
- . "The Pharmaceutical Industry -- Prices and Progress." *New England Journal of Medicine* 351, no. 9 (August 26, 2004 2004).
- Services, U.S. Department of Health and Human. "Guidance for Industry: Expedited Programs for Serious Conditions — Drugs and Biologics." (2014). <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/expedited-programs-serious-conditions-drugs-and-biologics>.
- Shunmay Yeung, Patricia Tabernero Harriet L. S. Lawford, Chea Nguon, Albert van Wyk, Naiela Malik,, Ouk Rada Mikhael DeSousa, Mam Boravann, Prabha Dwivedi, Dana M. Hostetler, Isabel Swamidoss,, and Facundo M. Fernandez Michael D. Green, and Harparkash Kaur. "Quality of Antimalarials at the Epicenter of Antimalarial Drug Resistance: Results from an Overt and Mystery Client Survey in Cambodia." *American Journal of Tropical Medical Hygiene* 92, no. 6 (2015): 39-50.
- Solutions, Fitch. "Namibia Pharmaceuticals & Healthcare Report." 2018.
- Song, Yan, Ying Bian, and Tianmin Zhen. "Making Medicines More Accessible in China: An Empirical Study Investigating the Early Progress of Essential Medicine System." *PLoS ONE* (2018). Published electronically August 2, 2018. <https://doi.org/10.1371/journal.pone.0201582>.
- Star, Morning. "Bolivia Introduces Health Care for All." *People's World*, March 4, 2019 2019.
- Supon Limwattananon, Viroj Tangcharoensathien, Tawekiat Boonyapaisarncharoen3 Kanjana Tisayaticom2, and Phusit Prakongsai2. "Why Has the Universal Coverage Scheme in Thailand Achieved a Pro-Poor Public Subsidy for Health Care?". *BMC Public Health* 12 (2012): S6.

- Tafari, G., P. Stolk, F. Trotta, and H. G. Leufkens<sup>2</sup> M. Putzeist<sup>2, 3</sup>, R. O. Laing<sup>4</sup> & M. De Allegri<sup>5</sup>. "How Do the Ema and Fda Decide Which Anticancer Drugs Make It to the Market? A Comparative Qualitative Study on Decision Makers' Views." *Annals of Oncology* 25 (2014): 265-69.
- "Thailand Issues Compulsory Licence for Patented Aids Drug." *Bridges* 10, no. 42 (2006). <https://www.ictsd.org/bridges-news/bridges/news/thailand-issues-compulsory-licence-for-patented-aids-drug>.
- Tim B Heaton, Benjamin Crookston, Renata Forste, and David Knowlton. "Inequalities in Child Health in Bolivia: Has Morales Made a Difference?". *Health Sociology Review* 23, no. 3 (2014): 208-18.
- Tremblay, Jean-François. "Thailand Embarks on Life Sciences Push: Reversing Its Long Neglect of R&D, Southeast Asian Country Now Encourages Biotechnology Innovation." *Chemical & Engineering News* 95, no. 21 (2017): 25-27.
- Vasontara Yiengprugsawan, Matthew Kelly, and Adrian C. Sleight<sup>1</sup> Sam-ang Seubsman<sup>2</sup>. "The First 10 Years of the Universal Coverage Scheme in Thailand: Review of Its Impact on Health Inequalities and Lessons Learnt for Middle-Income Countries." *Australas epidemiol.* 17, no. 3 (2010): 24-26.
- Victor S Pribluda, Adrian Barojas, Arletta Añez, Ruth Figueroa<sup>4</sup> Cecilia G López<sup>3</sup>, Roxana Herrera<sup>5</sup>, Fernando HA Nogueira<sup>7</sup> Gladys Nakao<sup>6</sup>, Gerson A Pianetti<sup>7</sup>, Marinete M Povoia<sup>8</sup>, Giselle MR Viana<sup>8</sup>, Jose P Escobar<sup>10</sup> Margarete S Mendonça Gomes<sup>9</sup>, Olga L Muñoz Sierra<sup>11</sup>, Susana P Rendon Norena<sup>11</sup>, Raúl Veloz<sup>12</sup>, Martha R Aldás<sup>13</sup> Marcy Silva Bravo<sup>12</sup>, Alison HindsSemple<sup>14</sup>, Marilyn Collins<sup>14</sup>, Nicolas Ceron<sup>15</sup>, Malti Adhin<sup>17</sup> Karanchand Krishnalal<sup>16</sup>, Gustavo Bretas<sup>18</sup>, Nelly Hernandez<sup>19</sup>, Marjorie Mendoza<sup>19</sup>, and Kennedy Chibwe<sup>1</sup> Abdelkrim Smine<sup>20</sup>, Patrick Lukulay<sup>1</sup> and Lawrence Evans III<sup>1</sup>. "Implementation of Basic Quality Control Tests for Malaria Medicines in Amazon Basin Countries: Results for the 2005–2010 Period." *Malaria Journal* 11 (2012): 202.
- Viroj Tangcharoensathien, Siriwan Pitayangsarit, Walaiporn Patcharanarumol, Phusit Prakongsai<sup>1</sup>, and Jiraboon Tosanguan<sup>1</sup> and Anne Mills<sup>2</sup> Hathaichanok Sumalee<sup>1</sup>. "Promoting Universal Financial Protection: How the Thai Universal Coverage Scheme Was Designed to Ensure Equity." *Health Research Policy and Systems* 11, no. 25 (2013).
- Viroj Tangcharoensathien, Supon Limwattananon, Walaiporn Patcharanarumol<sup>1</sup>, and Jadej Thammatacharee<sup>3</sup>. "Monitoring and Evaluating Progress Towards Universal Health Coverage in Thailand." *PLOS Medicine* 11, no. 9 (2014).
- Ward, Michael R. and Dranove, David. "The Vertical Chain of Research and Development in the Pharmaceutical Industry." *Economic Inquiry* 33, no. 1 (1995): 17.

- Weisbrod, Burton. "The Health Care Quadrilemma: An Essay on Technological Change, Insurance, Quality of Care, and Cost Containment." *Journal of Economic Literature* 29, no. 2 (June 1991 1991): 523-52.
- Welch, Anna Rose. "What to Know About Thailand's Life Sciences Industry." *Biosimilar Development*, May 12, 2017 2017.
- WHO. "Cambodia-Who Country Cooperation Strategy 2016-2020." 2016.
- Wim Van Damme, Luc Van Leemput, Ir Por, and Wim Hardeman<sup>2</sup> and Bruno Meessen<sup>1</sup>. "Out-of-Pocket Health Expenditure and Debt in Poor Households: Evidence from Cambodia." *Tropical Medicine and International Health* 9, no. 2 (2004): 273-80.
- Wouters, Olivier J., Martin McKee, and Jeroen Luyten. "Estimated Research and Development Investment Needed to Bring a New Medicine to Market, 2009-2018." *JAMA Network Open* 323, no. 9 (2020): 844-53.
- Zhou, Zhongliang, Yanfang Su, Benjamin Campbell, Zhiying Zhou, Jianmin Gao, Qiang Yu, Jiu hao Chen, and Yishan Pan. "The Financial Impact of the 'Zero-Markup Policy for Essential Drugs' on Patients in County Hospitals in Western Rural China." *PLoS ONE* (2015). Published electronically March 19, 2015. DOI:10.1371/journal.pone.0121630.