Extending the Cure: Policy Responses to the Challenges of Antibiotic Resistance

Evaluating incentives to reduce the demand for antibiotics and expand the supply of new ones

**SUMMARY**

Researchers working through Extending the Cure investigated antibiotic use and resistance, and evaluated incentives to encourage responsible use of existing antibiotics and the development of new ones. The project framed the challenge as one of safeguarding a shared social resource, highlighted the need for government stewardship, and emphasized media outreach as an educational tool and a strategy for influencing policy.

Extending the Cure began in 2005 under the auspices of Resources for the Future, a Washington-based research organization, and continued through 2012 under the Center for Disease Dynamics, Economics & Policy. The center, founded within Resources for the Future in 2009, became an independent organization the following year.

Ramanan Laxminarayan, PhD, served as project director, managing an interdisciplinary team of researchers at universities and other institutions across the country.

**Key Results and Findings**

Extending the Cure researchers:

- Published *Extending the Cure: Policy Responses to the Growing Threat of Antibiotic Resistance*,\(^1\) which identified incentives to reduce the demand for antibiotics and expand the supply of new ones.

- Published 23 journal articles and 13 policy briefs on trends in antibiotic use and resistance and incentive-based policy options.

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• Launched the **Drug Resistance Index**, which calculates the resistance of a microbe to all the drugs used to treat it as a single number, and allows users to track resistance over time.

• Developed the **ResistanceMap**, a website on antibiotic resistance, which illustrates patterns of antibiotic use and drug resistance across North America and Europe.

• Generated broad media coverage, including hundreds of stories in newspapers, magazines, online outlets, television, and radio, when new studies, updates to the ResistanceMap, or other resources were released.

The Robert Wood Johnson Foundation (RWJF) released a **YouTube** video about the project. Also see the **feature** on Extending the Cure on RWJF’s website.

### Funding

RWJF funded this project with three grants to Resources for the Future totaling $2,145,142.²

### CONTEXT

Antibiotics have saved millions of lives since they were first developed in the 1940s. However, microbes resistant to these drugs have spread rapidly in recent years. Pneumonia, gonorrhea, and salmonella are just a few of the diseases that have become harder to treat because of drug resistance.

More than 63,000 patients in the United States die every year from hospital-acquired bacterial infections that are resistant to at least one common antibiotic. For example, more than 50 percent of patients infected with *Staphylococcus aureus*—known as staph, a common cause of sickness and death in hospitals—failed to respond to methicillin, an inexpensive antibiotic, in 2004. Some 30 years earlier, just 2 percent of patients did not respond, according to the Centers for Disease Control and Prevention (CDC).³

Individual physicians, hospitals, farmers, drug companies, and patients have few incentives to consider the overuse of antibiotics, which leads to resistance. The American Society of Microbiology, the Institute of Medicine, and other experts have sounded calls to address this growing threat, yet policy-makers and other stakeholders have been unable to implement effective solutions.

² Grant ID# 52602 ($271,900, May 2005 to January 2007); ID# 60225 ($74,742, February 2007 to September 2007); and ID# 61119 ($1,798,500, June 2007 to December 2011).

³ See [www.cdc.gov/media/pressrel/r061019.htm](http://www.cdc.gov/media/pressrel/r061019.htm).
**Interagency Task Force on Antimicrobial Resistance**

According to the federal Interagency Task Force on Antimicrobial Resistance, “Unless antibiotic resistance problems are detected as they emerge, and actions are taken to contain them, the world could be faced with previously treatable diseases that have again become untreatable, as in the days before antibiotics were developed.”

**RWJF’s Interest in This Area**

In 2003, RWJF created the Pioneer Portfolio—a commitment to harnessing a pipeline of emerging ideas to serve the social good. The work of the team complements the more targeted efforts of the Foundation’s other teams.

The Pioneer Portfolio is uniquely suited to invest in innovation at many different stages. It seeks to:

- Identify and explore new issues and approaches
- Accelerate progress on issues and approaches that have significant potential to create breakthroughs in health and health care
- Support projects that use original, unconventional, or cross-sectoral approaches to create transformative change

Brian Quinn, PhD, the team director says of its strategy: “Pioneer tries to identify approaches or tools that have worked in other fields and apply them to challenges in health and health care.”

**THE PROJECT**

Extending the Cure researchers investigated antibiotic resistance, published reports on the scale of the problem, proposed policy solutions, and disseminated their findings. In so doing, the researchers framed antibiotic resistance as a problem of “the commons.” That is, antibiotics are a shared resource like clean air and safe drinking water, and any use of these drugs—appropriate or not—diminishes their overall effectiveness.

Traditional solutions have entailed using national guidelines to convince physicians to prescribe fewer antibiotics, and farmers to limit their use in animals. Extending the Cure tried to shift the perspective to creating incentives for physicians, farmers, drug companies, and patients to act in society’s best interests to prevent the emergence and spread of drug resistance to antibiotics.

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“Even with very good guidelines, it will be in physicians’ interest to give out more antibiotics, because they don’t bear the cost of resistance,” said Laxminarayan. “Patients don’t bear the costs, so they also demand antibiotics. Hospitals prefer to use fewer infection control techniques and more antibiotics. Pharmaceutical companies don’t bear the costs either, so they sell as much as they can.”

**Engaging Stakeholders**

To launch the project, researchers held four consultations in 2006 with 46 stakeholders from drug and insurance companies, health maintenance organizations, hospitals, and government, as well as physicians and academics. Participating organizations included the federal Interagency Task Force on Antimicrobial Resistance, the Infectious Diseases Society of America, and the Academy of Managed Care Pharmacy.

A five-member advisory committee, chaired by Kenneth Arrow, PhD, a Nobel Prize–winning economist at Stanford, helped guide the project (see the Appendix).

**Other Funding**

Resources for the Future contributed $54,000 to Extending the Cure. The CDC provided an 18-month, $250,000 grant to project researchers for a separate study, which began in 2011, on patterns of antibiotic use at six hospitals. (See [Afterward](#).)

**FINDINGS**

In *Extending the Cure: Policy Responses to the Growing Threat of Antibiotic Resistance*, a 175-page report, and a standalone 17-page executive summary, Project researchers reported these findings:

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As kids at camp we were taught to leave the forest as we found it for the next person to enjoy. It was a simple lesson about conservation and responsible stewardship of a valuable shared resource.

[This approach] also applies to another vital shared resource we don’t often stop to consider, but are at risk of overusing and depleting all the same—antibiotic effectiveness.

—Extending the Cure website

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• Reducing inappropriate antibiotic use is important but problematic, because what is good for individual patients conflicts with what is good for society.

• Antibiotics are an inexpensive substitute for infection control. Hospitals have little incentive to fully consider the adverse impact of poor practices to control infections because they share patients and problems with other facilities.

• Related antibiotics create cross-resistance, so each drug company has little incentive to consider resistance if other firms are selling similar drugs.

• Incentives for new drug development can help replenish the pipeline, but they are incomplete without incentives for drug companies to care about resistance.

• Maintaining the effectiveness of existing antibiotics and encouraging the development of new ones requires new policies that address both demand and supply:
  — Discourage inappropriate antibiotic use by changing how patients are reimbursed for antibiotic prescriptions, and how physicians are paid for prescribing them
  — Reduce the need for antibiotics by improving infection control in hospitals and vaccinating the public against common infections
  — Encourage the use of innovative strategies that delay the emergence of resistance, such as combination therapies and antibiotic cycling. The latter entails rotating the use of classes of antibiotics, especially in intensive care units.
  — Encourage the creation of truly novel antibiotics that do not inherit the resistance problems of their predecessors
  — Reduce incentives for drug companies to oversell their antibiotics

• Legislation that recognizes antibiotics as a shared resource, declares a national interest in preserving their effectiveness, and funds a lead agency to coordinate demand-side and supply-side efforts would ensure their sustainable use. A useful precedent is the effort by the Environmental Protection Agency to prevent the emergence of pesticide-resistant agricultural pests.

RESULTS

Project researchers reported these results to RWJF. They:

• Launched the Drug Resistance Index, which calculates the resistance of a microbe to all drugs used to treat it as a single number. An index could eventually be used to track each microbe in every country, allowing users to monitor resistance over time. Science magazine tagged the index “a Dow Jones for drug resistance.”

“Just as we don’t use the price of any single stock to understand how the overall stock market is doing, we shouldn’t use a resistance to any particular drug to explain a microbe’s overall resistance,” says Laxminarayan. “We found a way to combine information on a microbe’s resistance to all drugs in a single index.”

Project staff began partnering with hospitals to use the index to track the effectiveness of “antimicrobial stewardship programs,” which aim to ensure that patients receive the right antibiotic at the right dose at the right time.

- **Developed the ResistanceMap, which illustrates patterns of antibiotic use and drug resistance across North America and Europe.** The tool—the most popular feature on the Extending the Cure website—allows epidemiologists, hospitals, journalists, and the public to explore more than 50 indicators and highlights regional differences.

  Noting that “people are very visual,” Laxminarayan said the map was a very useful way to convey information in the scientific literature to a lay audience.

- **Released a consensus statement in November 2012 signed by 25 national organizations on the gravity of the resistance problem and the need for joint action.** Signatories included the Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), the Society for Infectious Disease Physicians, the Society for Infectious Disease Pharmacists, and the Association for Professionals in Infection Control and Epidemiology.

**Communications Results**

Communicating with policy-makers, clinicians, and the public was a core component of the project, and the researchers received considerable training from Spitfire Strategies, Burness Communications, and other consultants. An aggressive media outreach campaign accompanied the release of every Extending the Cure study, new versions of the ResistanceMap, and other resources.

Extending the Cure staff:

- **Published 23 journal articles and 13 policy briefs on trends in antibiotic use and resistance and incentive-based policy options.** Topics included:

  - Seasonal trends in antibiotic use and hospital infections
  - The use of antibiotic prescriptions as a proxy measure for certain infections
  - Incentives for reporting outbreaks of infectious disease and developing new antibiotics

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— The evolution of antimicrobial stewardship programs, and the effectiveness of physician education in promoting such stewardship

— The impact of drug pricing on behavior.

See the Bibliography for details.


For example:

— An article in the *Archives of Internal Medicine*[^8] about the costs of hospital-acquired infections generated 39 original stories, including coverage in the *Wall Street Journal* Health Blog, WebMD, four wire services, National Public Radio, and CNN.

— An article in *Emerging Infectious Diseases*[^9] about community-acquired MRSA generated 26 stories in wires, newspapers, television, radio, and online media, including international coverage in France and Singapore.

— An article in *Infection Control and Hospital Epidemiology*[^10] about *Acinetobacter*’s resistance to the antibiotics was featured in 22 stories, including wire services, newspapers, and blogs.

- **Partnered with the CDC on Get Smart About Antibiotics Week, an annual information campaign targeting the public.** Extending the Cure released new research and unveiled its consensus statement in sync with the 2012 Get Smart campaign, accompanied by media and social media campaigns that reached an estimated 1.9 million people through broadcast outlets, and generated more than 26 million impressions in two hours of tweeting.

- **Developed a website with information on antibiotic resistance and project publications.**


- Participated in workshops on antibiotic effectiveness, including one sponsored by the World Health Organization in June 2011.

- Met with congressional leaders and staff to discuss findings and the need for more research. Project staff also hosted two briefings, one for the House and one for the Senate, in July 2007. Senator Orin Hatch (R-Utah) later described antibiotic resistance as “similar to the problem of pollution and air and water, and a problem of the commons” on the Senate floor. “That’s really advanced thinking,” Laxminarayan said.

“Extending the Cure reframed the challenge of antibiotic resistance,” noted RWJF Senior Program Officer and Director of the Pioneer Portfolio Brian Quinn, PhD. “You don’t have to be an economist to understand the gravity of the problem and the policy options. They have simplified the messaging and put the findings together in a format policy-makers can understand.”

For more information also see the feature on Extending the Cure on RWJF’s website.

LESSONS LEARNED

1. When reframing an important concept, return to it repeatedly. “If this had been purely a research project, the reframing would have been lost in the shuffle, said RWJF’s Quinn. “Journals are not necessarily interested in a reframing—they are interested in the data and the findings. This project tried hard through both research and communications to come back to the reframing.”

2. Consider communications goals and strategies upfront, rather than waiting until research is complete. At first “we had the typical model of researchers: finish something, and then figure out how to get it out to those who might want to read it,” Laxminarayan noted. However, the training sessions with outside consultants “changed how we thought about communications, informing the questions we pursued and how.”

3. Balance communications’ staff desire for crisp numbers with the obligation to be precise. To create a single, strong statement as requested by RWJF communications team, researchers derived a statistic from a paper by Julie Gerberding, then CDC director for the Institute of Medicine. “We may have been unclear in how we derived this number,” says Laxminarayan. As a result, the agency could not confirm the statistic when asked by journalists to do so.

AFTERWARD

Researchers at the Center for Disease Dynamics, Economics & Policy are preparing Ten Steps to Protect the Crown Jewels of Modern Medicine, a summary of findings from their own research and that of others. They have finished collecting data for the CDC-funded study of antibiotic use in hospitals, and are developing a journal article.
Center staff will engage the network of organizations that released the November 2012 consensus statement to promote information sharing and coordination on combating resistance. The center is also extending its work overseas, using a $5.3 million grant from the Bill & Melinda Gates Foundation for the Global Antibiotic Resistance Partnership, which is developing policies to lessen antibiotic resistance in low- and middle-income countries.
APPENDIX

Extending the Cure Advisory Committee Members

(Current as of the end date of the program; provided by the program’s management; not verified by RWJF.)

Kenneth Arrow, PhD (Chair)
Joan Kenney Professor of Economics (Emeritus)
Professor of Operations Research (Emeritus)
Stanford University
Stanford, Calif.

Michael Dunne, MD
Chief Medical Officer
Durata Therapeutics
Morristown, N.J.

Donald Kennedy, PhD
President (Emeritus)
Bing Professor of Environmental Science and Policy (Emeritus)
Stanford University
Stanford, Calif.

Simon A. Levin, PhD, JD
George M. Moffett Professor of Biology
Director, Center for BioComplexity
Princeton University
Princeton, N.J.

Saul Levmore, JD, PhD
Dean (former) and William B. Graham Professor of Law
University of Chicago
Chicago, Ill.
BIBLIOGRAPHY

(Current as of date of the report; as provided by the grantee organization; not verified by RWJF; items not available from RWJF.)

Articles


**Book Chapters**


**Reports**


**Policy Briefs**


**Toolkits**

*ResistanceMap*. Interactive tool on trends in antibiotic use and resistance. This site also provides access to the Drug Resistance Index. Washington: Center for Disease Dynamics, Economics & Policy Available online.

**Communication or Promotion**

[www.extendingthecure.org](http://www.extendingthecure.org). Provides access to information on antibiotic resistance, potential policy solutions, and project publications.