Preparing for the Next Pandemic:
Medical Countermeasures in the 21st Century

Stefan Elbe, Anne Roemer-Mahler & Christopher Long

Summary

Threatening outbreaks of deadly infectious diseases like Zika, Ebola and pandemic flu show that governments cannot secure their populations with armed force alone. In an increasingly interconnected world, they must also find ways to protect their societies against an array of biological dangers. The spread of a new pandemic, a bioterrorist attack, or even an accidental laboratory release could each cause mass deaths and crippling economic shocks. The ability to rapidly develop new medicines and vaccines – or 'medical countermeasures' – against such threats is thus becoming more central to the security policies of several governments.

Yet developing new medical countermeasures is extraordinarily complex and costly. This has also meant that new pharmaceutical defenses were not available at the height of several recent outbreaks, leading to widespread loss of life:

- What are the obstacles involved in developing new medical countermeasures?
- How could governments and companies improve their medical countermeasure capabilities?
- Can the development of new medical countermeasure be advanced by greater *international* collaboration?

This brief outlines the key challenges involved in developing new medical countermeasure, and identifies the steps that could be taken to improve the process in future.

The Challenge

Lethal infectious disease outbreaks continue to threaten populations in the 21st century – from HIV/AIDS, SARS, and pandemic flu, through to MERS, Ebola and now the Zika virus. Such outbreaks provoke immense public fear, cause economic disruption, and generate strong political pressure for governments to respond decisively – especially in an era where infectious diseases can rapidly spread internationally. Yet vital medicines and vaccines were not readily available at the height of any of those outbreaks – leading to widespread loss of life. Why is it so hard to develop medical countermeasures against lethal infectious disease outbreaks, all the recent advances in biomedicine notwithstanding? What can be done to improve global preparedness for future outbreaks? Will we ever get to a point where governments can rapidly make new medicines and vaccines available in response to a new outbreak?

The Research

This five-year project analyzed the multiple challenges involved in developing and deploying new medical countermeasures. To identify those challenges, the study systematically 'shadowed' the antiviral medication *Tamiflu* as it passed through each stage of its life-cycle – from its initial discovery and commercial development, via the relevant regulatory processes and government decisions about stockpiling, to its eventual mass public distribution during a global health security crisis. *Tamiflu* was chosen because: 1) it is arguably the world's most prominent medical countermeasure (stockpiled by around 100 governments around the world); 2) it was widely distributed to citizens during the 2009-10 (H1N1) influenza pandemic; and 3) it has also attracted a considerable amount of public controversy.

Key Information:

- The research leading to these results has received funding from the European Union's Seventh Framework Program (FP/2007-2013) ERC Grant Agreement n. 312567: *'Pharmaceuticals and Security: The Role of Public-Private Collaborations in Strengthening Global Health Security'*.
- Professor Stefan Elbe, Director, Centre for Global Health Policy, Professor of International Relations, School of Global Studies, University of Sussex, Brighton BN1 9SN, United Kingdom. s.elbe@sussex.ac.uk.
- Project Website: http://www.sussex.ac.uk/globalhealthpolicy/research/pharmaceuticalsandsecurity

Key Messages

- People need protection against deadly infectious disease outbreaks
- New pharmaceutical defences for populations are urgently required
- Developing such 'medical countermeasures' is a highly complex process
- Recent controversies around *Tamiflu* illustrate the many challenges involved
- New capabilities will require a holistic and sustainable approach

University of Sussex
Centre for Global Health Policy

European Research Council
Established by the European Commission

Preparing for the Next Pandemic

The Findings

Developing new medicines and vaccines against health security threats involves a unique constellation of challenges – especially when compared to more routine drug development. Broadly speaking there are three sets of challenges:

Development Challenges – around their initial development:

- *Scientific:* Developing new medical countermeasures is scientifically very demanding and complex. Doing so thus takes a considerable amount of time. Success is rare and often involves a mixture of rational drug design and serendipity.
- *Economic:* Developing new medical countermeasures is very expensive, yet in many cases there is no commercial market to underpin these products. Persuading pharmaceutical companies to prioritize such products is challenging, unless a way of sharing the commercial risks can be found.
- *Late-Stage Development*: Once a new compound is discovered, there are additional challenges with developing it into a viable medical countermeasure (such as carrying out clinical trials, gaining regulatory approval, mass manufacture, etc.). Many promising medical countermeasure candidates are never developed and succumb to the developmental 'valley of death', whereby companies are not willing to take a promising compound forward.

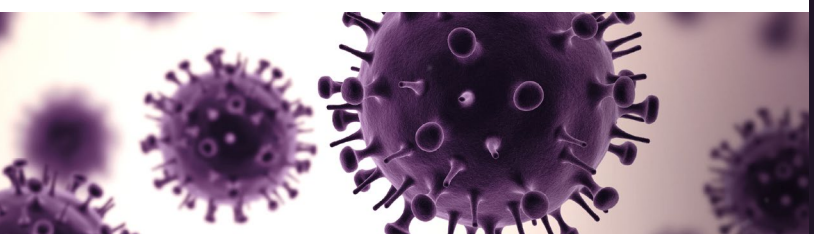
Approval Challenges – around their approval, testing and patenting:

- *Regulatory*: Obtaining regulatory approval for medical countermeasures can be particularly challenging. That is because the diseases against which they are developed may not occur naturally, or they may not occur in very large numbers. It is therefore not feasible to carry out clinical trials, and deliberately infecting large numbers of people would not be deemed ethical.
- *Data Access*: Because pharmaceutical companies usually produce clinical trial data, they tend to control which data is released to the public and to the regulators. During a public health emergency, however, there will likely be calls for all data to be made accessible and subject to independent scrutiny. Decisions by companies, regulators and governments may therefore face heightened scrutiny.
- *Intellectual Property*: Pharmaceutical companies usually protect their financial investment in new medicines through patents. During emergencies and security crises such patents become legally more vulnerable to suspension – generating additional commercial risks for producers of medical countermeasures in particular. These may serve as a deterrent to pharmaceutical companies taking on such products.

Deployment Challenges – around their stockpiling and mass distribution:

- *Supply Chain*: During a global health security crisis, demand for any medical countermeasures is likely to surge dramatically. Without an underlying commercial market for medical countermeasures, there are challenges with how to rapidly scale up production capacity to meet that surge in demand.
- *Global Access*: During a widespread outbreak, it is likely there will insufficient quantities available to cover global demand. This leads to an equity issue at global level that can generate international diplomatic tensions.
- *Liabilities for Injuries*: Rapidly rolling out a new medical countermeasure to a large number of people during a public health emergency could lead to the emergence of harmful side effects. The legal and financial liabilities associated with such injuries could be severe, and represent another risk for companies developing such products.

All of these challenges are also enveloped by a wider *political* challenge, due to the significant costs involved in procuring new medical countermeasures. Public perceptions of waste can arise because medical countermeasures may expire before they are ever used, and conflicts of interests may also emerge as governments and industry partner more closely to develop new medical countermeasures.



Policy Implications

The inherent complexity of medical countermeasure development means there is no 'magic bullet' available to governments wishing to encourage the commercial development of new pharmaceutical defenses. However, the experience in the United States suggests that it is possible for new medical countermeasures to be commercially developed when governments take a longer-term view, and produce a more holistic policy environment using a broad mix of incentives, regulatory adjustments, legal measures, and so forth. Depending on their respective risk assessments, governments interested in developing such a medical countermeasure capability may wish to consider the following 'checklist' of possible actions:

1. Create and communicate clear assessments for threats requiring the development of new medical countermeasures.
2. Invest in basic scientific research as a way of increasing the chances for finding new kinds of therapies in future.
3. Incentivise smaller- and medium-sized pharmaceutical companies (as they have lower opportunity costs), but consider providing support for subsequent stages like development, regulatory approval, and manufacturing.
4. Generate regulatory pathways that recognize the unique challenges involved in developing medical countermeasures, and work with international partners towards their greater harmonisation.
5. Maintain clear boundaries between regulatory and procurement authorities within government, and use robust conflict of interest policies to sustain public trust.
6. Develop stockpiles and credible logistical systems for medical countermeasure deployment during a public health emergency.
7. Establish a fair and transparent mechanism for addressing the legal and financial liabilities associated with the possible side effects of medical countermeasures.
8. Invest in the capability to rapidly scale up the production and distribution of medical countermeasure during a public health emergency.
9. Clarify arrangements for ownership and access to clinical trial data for medical countermeasures.
10. Develop an international access strategy for medical countermeasures during emergencies.

Resources

- Stefan Elbe, Anne Roemer-Mahler, and Christopher Long (2014) 'Securing circulation pharmaceutically: antiviral stockpiling and pandemic preparedness in the European Union'. *Security Dialogue*, 45(5): 440-457;
- Stefan Elbe (2014) 'The pharmaceuticalisation of security: molecular biomedicine, antiviral stockpiles, and global health security'. *Review of International Studies*, 40(5): 919-938;
- Stefan Elbe, Anne Roemer-Mahler, and Christopher Long (2015) 'Medical countermeasures for national security: a new government role in the pharmaceuticalization of society'. *Social Science and Medicine*, 131: 263-271;
- Anne Roemer-Mahler and Stefan Elbe (2016) 'The race for Ebola drugs: pharmaceuticals, security and global health governance'. *Third World Quarterly*, 37(3): 487-506
- Stefan Elbe and Anne Roemer-Mahler (2014) *Pharmaceuticals and Security: Strengthening Industry Engagement Future directions in public-private collaboration for health security.* Summary Report. Centre for Global Health Policy, University of Sussex. https://www.sussex.ac.uk/webteam/gateway/file.php?name=erc-report.pdf&site=346