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Is there a role for the Biological Weapons Convention in oversight of lab-created potential pandemic pathogens?

By Lynn C. Klotz, August 27, 2019



Research by Ron Fouchier in the Netherlands and Yoshihiro Kawaoka in Madison, Wisconsin marked the beginning of a “research enterprise” aimed at creating mammalian-airborne-transmissible, highly-pathogenic, avian-influenza live viruses. Such viruses could be transmitted through the air, similar to seasonal human influenza. Through November 2018, [14 laboratories have been identified](#) in this enterprise.

These viruses are examples of lab-created potentially pandemic pathogens that bring up questions reflecting real concerns: Should details of this dual-use research be published? Could lab-created potentially pandemic pathogens be accidentally released from a laboratory into the community and seed a human pandemic? Could they be employed as biological weapons?

The probability of accidental release into the community from one of the laboratories in this research enterprise is uncomfortably high. For these and other lab-created potentially pandemic pathogens, just one laboratory-infected researcher could seed a pandemic. Concern over a pandemic from a research enterprise laboratory release should rival our grave concern over a natural pandemic; the [likelihood of both is similar](#). Furthermore, a laboratory worker with hostile intent could introduce a potentially pandemic pathogen into the community.

Seeding a pandemic is not a problem for future consideration; the possibility is upon us now. There is an urgent need for international oversight and regulation of this research.

The countries that are party to the [Biological Weapons Convention](#) (BWC) may not believe it to be within the BWC mandate to oversee academic research whose goal is public health. But if the parties decide this kind of oversight is within the BWC mandate (under Article XII), guidelines and regulations could be enacted fairly quickly. At the very least, the parties could act as a catalyst, launching discussions toward a new international treaty on oversight and regulation of this dangerous research. In the meantime, since enacting new treaties is an uncertain and long process, the BWC parties should work to pass legislation in their nations.

A background of questionable research. In 2012, Fouchier [published](#)^[1] the creation of mammalian aerosol-transmissible avian influenza virus of the H5N1 strain. This virus is responsible for bird flu outbreaks in Asia, and it kills 60 percent of poultry workers who become infected, mostly through close contact with infected poultry.

Research by Fouchier and [Kawaoka](#)^[2] marked the beginning of a “research enterprise” for creating airborne-transmissible and potentially pandemic pathogens in the laboratory. In 2013, in letters to the journals [Science](#) and [Nature](#),^{[3],[4]} 22 virologists notified the research community of their interest in creating airborne-transmissible strains of the also deadly H7N9 Asian

influenza virus. As of 2016, considerable [research has been documented^{\[5\]}](#) on understanding how H7N9 and other avian flu viruses might be made mammalian-airborne-transmissible. The efforts of this research enterprise raise a number of profound questions.

Should details of this dual-use research be published? The methods used to create these airborne-transmissible viruses are straightforward and could be reproduced by researchers not highly skilled in molecular virology.

Furthermore, skilled molecular virologists could re-create these viruses by directly making the necessary genetic modifications in the laboratory. Re-creating mammalian-airborne-transmissible, highly pathogenic, avian-influenza and other potentially pandemic pathogens brings up the serious biosecurity concern of their use for hostile purposes.

[Criteria^{\[6\]}](#), established in 1982 for making decisions about publication of dual-use research have been applied recently by Stanford's David [Relman^{\[7\]}](#) to lab-created potentially pandemic pathogens. The criteria, as described by Relman are:

"[Four] criteria to define research for which communication ought to be limited (all of which must be met): (1) research with dual use or military applications, (2) research with a short time to such applications, (3) research when dissemination could give short-term advantage to adversaries, and (4) research when the information was believed not to be already held by adversaries."

For some lab-created mammalian-transmitted avian influenza viruses, not publishing is no longer a choice, as details needed for airborne transmission in mammals have already been published.

Could a release from the laboratory into the community seed a pandemic?

For 14 research enterprise facilities researching for five years, conservatively, the probability of release from at least one of the labs into the surrounding community is about 16 percent, according to Federal Select Agent Program (FSAP) lab-incident data (manuscript submitted to *Frontiers in Bioengineering and Biotechnology: Biosafety and Biosecurity*). The data are for pathogen releases from biosafety level three (BSL3) laboratories. These laboratories have many features designed to protect laboratory workers from infection and to reduce the probability of a release of pathogens into the

surrounding community. Even so, this is an uncomfortably high probability of release into the community for five-years of research.

NIH lab incident data tell a much more alarming story. By those data, the probability is 68 percent for five years of research. The reasons for this large difference between the Federal Select Agent Program and National Institutes of Health probabilities can only be guessed at. Much of the NIH data is for less dangerous pathogens, so perhaps laboratory workers become infected more easily as they are not as cautious as they should be.

The calculation results summarized here will employ only the conservative select agent program data. Nonetheless, the high probability of release from the NIH data is real, so must be kept in mind.

From two very different methods of estimating the probability of a pandemic arising from a single infected person—one described in a paper by Marc [Lipsitch](#) of the Harvard School of Public Health and his co-authors^[8] and the other in a paper by Stefano [Merler](#)^[9] of the Bruno Kessler Foundation and his co-authors—I have calculated that the pandemic probability ranges from 5 percent to 40 percent. Taking an arbitrary intermediate value of 15 percent, the probability that the research enterprise seeds a pandemic in five years of research is equal to the probability of a lab release times the probability of a pandemic which is 2.4 percent. The quick spread of the 2009 H1N1 pandemic virus throughout the world, no matter what attempts were made to slow it, is convincing evidence that it is nearly impossible to stop an influenza pandemic once it appears.

Since the number of fatalities from a lab-created pandemic could be in the millions, a 2.4 percent probability that it will happen is much too high. Should the world be willing to risk a 2.4 percent likelihood of a pandemic from the research enterprise over five years of research that may not yield practical results?

We can't know how virulent or airborne transmissible in humans these potentially pandemic viruses would be when released into the community, because we can't do the experiment. Just the possibility of a pandemic dictates that we must proceed with the utmost caution.

Are lab-created potential pandemic pathogens biological weapons? The possibility has been raised that airborne-transmissible avian flu viruses could

be used as biological weapons. In [a 2012 comment in the science journal *Nature*^{\[10\]}](#), the National Science Advisory Board for Biosecurity voiced its concern:

Dual use is defined as research that could be used for good or bad purposes. We are now confronted by a potent, real-world example... If influenza A/H5N1 virus acquired the capacity for human-to-human spread and retained its current virulence, we could face an epidemic of significant proportions... Recently, several scientific research teams have achieved some success in modifying influenza A/H5N1 viruses such that they are now transmitted efficiently between mammals, in one instance with maintenance of high pathogenicity... [T]hese scientific results also represent a grave concern for global biosecurity, biosafety and public health. Could this knowledge, in the hands of malevolent individuals, organizations or governments, allow construction of a genetically altered influenza virus capable of causing a pandemic? ... Our concern is that publishing these experiments in detail would provide information to some person, organization or government that would help them to develop similar mammal-adapted influenza A/H5N1 viruses for harmful purposes.

Another concerned voice is found in [a lead editorial in the journal *Science*^{\[11\]}](#) by Nobel Laureate Paul Berg:

Recent research with a highly pathogenic influenza virus has highlighted the importance of this issue. Reviews of the influenza research concluded that given “the risk of accidental or malicious release,” the benefits of such studies must be well justified. Thus, specific guidelines must be enforced to thwart not only intentionally harmful outcomes but accidental releases as well... Earlier this year, the NSABB was embroiled in a high-profile decision regarding the publication of research on enhanced transmissibility of the avian H5N1 influenza virus. The principal concern was that publishing such findings might embolden those with sinister motives to use that information to create a worldwide pandemic.”

The phrases “malevolent individuals, organizations, or governments,” “intentionally harmful outcomes,” and “sinister motives” describe the employment of these lab-created pathogens as biological weapons.

The Biological Weapons Convention was written with a focus on military tactical biological weapons, where significant quantities would usually be employed. Article I of the convention speaks to this focus:

Article I

Each State Party to this Convention undertakes never in any circumstances to develop, produce,

stockpile or otherwise acquire or retain:

(1) Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;

(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

For lab-created potentially pandemic pathogens, any quantity, however small, could seed an outbreak or pandemic. In this circumstance, development also implies production and stockpiling, since a single vial of infectious agent and one to a few infected individuals are all that is necessary to launch an attack.

From a military tactical point of view, however, lab-created pandemic pathogens would not be good biological weapons; they would boomerang back on the attackers since they are highly transmissible. Nonetheless, a suicidal terrorist group or a desperate country might employ them as a last resort, or threaten to employ them as a means of extortion.

Call for action from the parties to the BWC. When Fouchier and Kawaoka carried out their research, it was unlikely that biological weapons even crossed their minds. Since that possibility has now been brought up, researchers who are creating potentially pandemic pathogens must take into account the biological weapons risk of both dual-use information and laboratory release of their pathogens. If there is little public-health benefit or little defense rationale for particular research, the parties to the BWC should question whether the research is biological weapons development and act accordingly.

This is a complex issue. The question of what constitutes biological weapons development is complicated. Many biodefense activities of the US

Department of Homeland Security's proposed and now abandoned National Biodefense Analysis and Countermeasures Center would be considered biological weapons development. As pointed out in [a letter^{\[12\]}](#) in the journal *Politics and the Life Sciences*:

Taken together, many of the [proposed] activities...—most particularly the “Store, Stabilize, Package, Disperse” sequence and the “Computational modeling of feasibility, methods, and scale of production” item—may constitute development in the guise of threat assessment, and they certainly will be interpreted that way.

Lab-created potentially pandemic pathogens are an urgent focus, particularly mammalian-airborne-transmissible, highly-pathogenic, avian-influenza viruses, because they are already present in laboratories around the world.

Article XII of the Biological Weapons Convention calls for “review [of] the operation of the Convention ... assuring that the purposes of the preamble and the provisions of the Convention ... are being realized. Such review shall take into account any new scientific and technological developments relevant to the Convention.”

Hopefully, the states that are party to the BWC will set in motion a process for overseeing relevant new research and technologies. If they decide that lab-created potentially pandemic pathogens are within the BWC mandate under Article XII, they could speed up the enactment of guidelines and regulations. At the very least, BWC member countries could be the catalyst to launch discussions for a new international treaty on oversight and regulation of the creation of and research on highly dangerous pathogens. In the meantime, since enacting new treaties is an uncertain and long process, the states that are party to the BWC should pass legislation in their nations that strictly regulates research into and creation of pathogens that might kill millions around the world.

Notes

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