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Plagued by Errors: New Approach Needed to Tackle Proliferation Threats from Anti-Plague System

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The former Soviet anti-plague system stands today as a little-known but profoundly important proliferation challenge facing the international community. The Soviet Union managed this unique system, consisting of more than 80 facilities, to control deadly endemic diseases and to prevent the spread of exotic pathogens. Until recently, however, the anti-plague system's other role—contributing to the Soviet biological weapons program—has been overlooked.

Today, the anti-plague system retains the raw material and knowledge highly sought after by bioterrorists. What's more, more than a decade of fragmentation has resulted in lax security, severely underpaid staff, and virtually no accounting system for highly lethal strains of viruses and bacteria. While international donors have taken some steps to contain the system's physical security threats, existing and prospective nonproliferation efforts are not substantial enough and somewhat off the mark. Such efforts will not be truly effective until they rein force the important public health benefits these facilities offer.

Historical Roots

Created by the tsars in the 1890s to respond to numerous outbreaks of plague, the anti-plague system, then composed of 11 laboratories, experienced a dramatic expansion under Soviet rule. By the late 1970s, the system was composed of 87 facilities engaged in disease surveillance, research, production and testing of vaccines and laboratory equipment, and training of civilian and military personnel. The system employed a staff of 14,000, including 7,000 scientists whose expertise broadened beyond plague to other endemic zoonotic[1] diseases, such as anthrax, brucellosis, tularemia, and Crimean-Congo hemorrhagic fever. Most importantly, the anti-plague system stretched beyond Russian borders into Central Asia, the Caucasus, Ukraine , and Moldova, with facilities strategically located in 11 republics.

In the early 1960s, the system, until then primarily engaged in defending the country against endemic and exotic diseases, experienced a profound turning point: it was enlisted to support the Soviet biological weapons program. Initially, anti-plague facilities contributed to the defensive biological weapons program by providing the military with samples of dangerous pathogens, conducting research, training military scientists, and producing vaccines for mobilization purposes. Rapid response teams were also created at anti-plague facilities and were trained to deploy rapidly to an outbreak location in order to determine whether the disease occurred naturally or was the result of a biological attack. In the 1970s, the anti-plague system's involvement in the Soviet biological weapons program went a step further, when selected facilities started contributing to the offensive biological weapons program. This also led to the system's rapid militarization, with military officers appointed to head key anti-plague facilities.

Three degrees of involvement in the Soviet biological weapons program existed within the anti-plague system. The first, and probably the largest, consisted of a "blind" contribution, where scientists' research was used for the biological weapons program unbeknownst to the researchers. This happened through military monitoring of the work of anti- plague facilities. This process was facilitated by the centralization of research and disease surveillance findings in a central database, and the review of their research findings at two anti-plague institutes in Saratov and Rostov headed by military officers.

The second level of involvement consisted of small teams of researchers working on secret programs in various anti-plague facilities, with only the research team leaders aware of the work's purpose.

A third type of research, concentrated at major anti-plague institutes such as at Saratov, Rostov, and Volgograd, consisted of a more active role in the offensive and defensive programs.

In spite of their biological weapons work, anti-plague facilities preserved their original public health mission of protecting against endemic and imported dangerous diseases. Even at sites that were actively involved in the biological weapons program, civilian and biological weapons work was conducted in parallel but separately. In most cases, biological weapons activities did not adversely affect public health activities.[2]

Post-Soviet Fragmentation

On the eve of the Soviet Union's dis solution, the anti-plague system had 89 facilities, including six central institutes, 29 regional anti-plague stations, and 53 field stations located in 11 republics of the former Soviet Union. The system employed about 10,000 personnel, including 2,000 scientists. After the Soviet Union's dissolution, anti-plague facilities were reorganized as independent national networks in each newly independent state, with one facility taking the role of the new network's center.[3

Yet, the anti-plague system lost its organizational cohesion. Soon after 1992, most ethnic-Russian personnel working at anti-plague facilities in non-Russian former Soviet republics returned to Russia to work at Russian anti-plague facilities or other research institutes. The loss of personnel continued steadily as economic circumstances worsened in the newly independent states.

To make matters worse, conflicts arose in several of these states over the control of the anti-plague system. Some officials favored preserving anti-plague facilities because of their unique experience and knowledge while others sought to integrate anti-plague facilities into the Sanitary Epidemiological System (SES), a network of facilities with more traditional public health responsibilities such as vaccination and sanitation. These conflicts subsided after a 1999 plague outbreak in Kazakhstan made clear the value of the anti-plague facilities. Plans to integrate the anti-plague and SES systems were shelved.

Nevertheless, this tumultuous period exacerbated the anti-plague facilities' already precarious financial situation. On average, they lost about 50 percent of their budgets and 40 percent of their staff. The scientists that remained received low salaries and irregular payments, which in 2004 ranged from $20 to $100 per month for senior scientists with 25-30 years of experience. With salaries often lower than the regional average, anti-plague facilities have been unable to replace lost personnel with a new generation of specialists.

Proliferation Threats

The resulting proliferation danger is palpable. Foremost is the high risk of brain drain. Considering the undocumented outflow of personnel that began soon after 1992, it is quite possible that some leakage has already occurred. According to anti-plague system directors and veterans, most of the "lost" personnel were technicians and support staff. Fortunately, facilities have generally been able to preserve their scientific personnel, many of whom have passed retirement age. Nonetheless, even personnel still employed by the anti-plague facilities may continue to pose a proliferation threat. These include scientists and technicians with biological weapons knowledge, as well as other scientific personnel who may not have, at least knowingly, worked on the biological weapons program but who possess experience and knowledge of biological weapons relevance. More particularly, anti-plague scientists are accustomed to working with low-technology equipment and are trained to isolate pathogens in harsh field conditions, often finding their way to natural foci of dangerous diseases just using their memory. These qualities would be of great interest to criminal or terrorist groups who wish to preserve the secrecy of their activities.

The Soviet Union's dissolution also gravely affected the implementation of security measures at anti-plague facilities. In Soviet times, the sophistication of the anti-plague facilities' security systems depended on their degree of involvement in the biological weapons program. The systems ranged from on-site KGB officers, Ministry of Interior troops guarding facility perimeters, and fences topped with barbed wire to police communication lines and alarm systems with motion detectors on doors and windows, particularly in the pathogen collection rooms.

There were also strict regulations on the storage and transportation of dangerous pathogens. For instance, pathogens were either transported by a special service with armed guards or transferred by at least two members of the scientific staff by car, train, or plane. Strict safety regulations were also imposed for laboratory work with dangerous pathogens. Even though the governments of the newly independent states adopted Soviet-era regulations on safety and security, funding and personnel shortfalls severely affected their implementation. The security systems have collapsed in most facilities. Ministry of Interior and police protection are no longer available; barbed wire on fences are often stolen and sold as scrap metal; alarm systems no longer work due to frequent power cuts and lack of maintenance; and fences have collapsed due to lack of repairs, leaving the territory of these facilities essentially open to intruders.

The low level of physical security together with an inadequate accounting system also put at risk anti-plague facilities' collections of pathogens. These constitute a unique historical database of hundreds of strains from various regions of the former Soviet Union assembled over several decades. Although most strains have been isolated from nature, some possess features making them ideal raw materials for biological weapons: high virulence and inherent antibiotic resistance. Yet, pathogens are typically stored in kitchen refrigerators secured with simple locks or wax seals, making them highly vulnerable to diversion or theft. Moreover, vials containing the pathogens are typically labeled, facilitating their identification by intruders. In addition, accounting of pathogens is done on paper logs that are generally stored on bookshelves and could become accessible to intruders.

Another security risk is the absence of background security checks. Without the support of police or security services, most anti-plague facilities abstain from conducting such checks. Many facility directors admit that the only job requirements today for new applicants are "scientific qualifications and good health."

Diversion of pathogens could also occur during pathogen transfers from the natural foci where they are isolated to a field or regional station or during later transfers to central institutes for long-term storage. Neither reliable communications nor any position-location technology exists should emergencies arise. For instance, in the late 1990s an epidemiological team monitoring a plague focus in Kazakhstan's desert got lost and had a serious car accident. Out of radio contact range and without any bearing, several team members succumbed to injuries before their extended absence led to rescue operations. Should incidents occur during transfers, whether they are accidental or malevolent, there is a high probability that the chain of pathogen custody will be broken.

Geography Matters

Roughly 60 anti-plague facilities are located in Central Asia and the Caucasus, which concentrate the largest and most active natural disease foci. This area, however, is the meeting point of all the proliferation chain components: suppliers, established trafficking networks, and potential buyers. It is also a region where borders remain largely unprotected. [4]

Many anti-plague facilities are located on or near the trafficking routes for drugs, small arms, and weapons of mass destruction-related material that cross Central Asia and the Caucasus and proceed northwest through Turkey into Europe.

Several terrorist groups are also active in the region, such as the Islamic Movement of Uzbekistan, which seeks to overthrow the Uzbek president and install an Islamic regime. The wars in neighboring Afghani stan and Iraq have only exacerbated the problem. Moreover, since the Soviet Union's dissolution, political unrest and civil wars have fostered regional instability, as demonstrated by the recent revolutions in Georgia and Kyrgyzstan and public protests in Uzbekistan. This potentially explosive mixture puts anti-plague facilities at greater risk of being caught in factional entanglements and makes them more susceptible to intrusion or theft, with unpredictable proliferation consequences.

To be sure, there have been no indications to date that local terrorist groups have demonstrated an interest in or the capability to use biological weapons. Although there have been numerous outsider facility intrusions over the years, most often they involved intoxicated individuals or people interested in stealing scrap metal. Anecdotal accounts about the theft or attempted insider diversion of pathogens have not led to any known arrests because facility management preferred solving these problems without local police.

Nevertheless, more effective security measures at anti-plague facilities are imperative. In present conditions, dangerous biomaterials, as well as the knowledge and skills of system personnel, are at risk. More particularly, anti-plague specialists' ability to work in a low-technology environment and in field conditions makes them attractive to terrorist groups or states with limited access to high-technology bioequipment. Revelations about Iraq's use of calutrons for electromagnetic separation of uranium isotopes in the 1980s, a technology declassified by the United States in 1949, should serve as a reminder that technologies regarded as obsolete may still pose threats.

International Assistance Wanting

At present, the anti-plague system receives little assistance from the international community. Perhaps the most significant contribution, however, has come from the United States through its Cooperative Threat Reduction (CTR) program.

The CTR program currently supports security upgrades at three facilities in Kazakhstan , Uzbekistan, and Georgia. Security upgrades at the anti-plague institute in Almaty, Kazakhstan, transformed a facility with no security features into a secured area with a high fence topped with barbed wires, armed guards, motion detectors, and rein forced doors, among other things. Similar upgrades are planned or are under way at the anti-plague institutes in Tashkent, Uzbekistan , and Tbilisi, Georgia. With the recent signature of agreements with Ukraine and Azerbaijan, similar programs will be implemented at two anti-plague facilities in these countries.

To prevent brain drain, CTR has funded five scientific cooperative projects at the same facilities thus far: three at the Almaty institute, which also involves personnel at regional stations, and one each at the Tashkent and Tbilisi institutes. Together, these projects employ 52 scientific personnel and deal with dangerous pathogens of public health and security relevance.

Long-standing CTR intentions to implement a Threat Agent Detection and Response (TADR) system also appear to be making some progress. The TADR sys tem aims to create a disease surveillance network composed of central strain repositories and several sentinel laboratories in Kazakhstan, Uzbekistan, and Georgia to furnish early detection of a possible malevolent release of pathogens causing human or animal diseases. State governments, in cooperation with the Department of Defense, will decide which facilities to include in the TADR network. To date, the anti-plague institutes in Almaty, Tashkent, and Tbilisi have been chosen to be central strain repositories in each country, and one anti-plague station in Georgia was selected as a sentinel station. It is not clear yet how many other facilities will be chosen as sentinel laboratories.

CTR Program Effectiveness

Despite its positive results, the CTR program remains insufficiently comprehensive to address the system's proliferation threat. CTR-funded biosecurity upgrades, as well as cooperative research projects, reach only three anti-plague facilities while dozens of facilities still require support.

Although the TADR system is a model project because it addresses both security and public health concerns of national and international importance, it only superficially benefits the anti-plague system. Anti-plague facilities account for only a small number of TADR facilities, which include veterinary institutes, the SES, and epidemiological hospitals. It is at once surprising and mystifying that a program resting on disease surveillance to detect and prevent the malevolent use of dangerous pathogens does not exploit the very system with the best skills and experience in the field. The fault, however, does not necessarily lie with the CTR program. In some countries, revived conflicts between supporters of the anti-plague system and the SES have thwarted the inclusion of anti-plague facilities in the project.

Even assuming that the CTR program will eventually expand to include a greater number of anti-plague facilities, it may still fail to address the system's proliferation threats because of a conceptual flaw in the U.S. approach. In the biological weapons area, the CTR program aims to consolidate dangerous material at a small number of sites to facilitate their protection. This approach makes sense with former biological weapons facilities that were, in Soviet times, primarily engaged in military work because many have struggled unsuccessfully to find a new civilian or commercial mission.

When applied to the anti-plague sys tem, however, this approach negatively impacts the system's public health mission because it ignores the nature of the anti-plague system's work. The prevention of outbreaks necessitates the constant monitoring of natural foci and the isolation of natural strains. Funding limits and the loss of qualified personnel have already decreased anti-plague facilities' disease surveillance activities by 60 percent since 1992. As a result, whole areas endemic for plague, anthrax, and other dangerous diseases have remained un monitored, some for more than a decade. In this context, consolidating facilities or closing them will only exacerbate the public health threat, and ignoring them will increase the proliferation threat.

A More Comprehensive and Nuanced Approach

Addressing threats associated with the anti-plague system requires a more comprehensive and nuanced policy composed of measures that simultaneously grapple with security and public health challenges. CTR-funded projects, because they concentrate on a narrow set of security threats, constitute only a small part of this approach. Other agencies in Canada, Europe, the United States, and other Group of Eight members must become engaged to deal with the other security and public health challenges posed by the system. Newly independent state governments must also be involved to ensure that pro grams funded by the international community will be useful and sustainable in the long term.

Given the current state of the anti- plague system, priority should go to improving security to prohibit unauthorized access to dangerous pathogens. Unlike the traditional one-size-fits-all approach used thus far in the CTR program, tailored security solutions should be implemented depending on a facility's location and size, the character of its pathogen collection, and the activity level of the natural foci it monitors.[5]

All anti-plague facilities have collections of pathogens, but some house temporary collections while others retain permanent ones. Central anti-plague facilities in each country serve as national repositories, housing large and permanent collections. These require a complex security system, involving fences, alarm system, guards, video cameras, outside lights, and secured refrigerators to store the pathogens. Ac counting system modernization is also essential; a computerized system would provide fewer opportunities to conceal the movement of pathogens. The use of bar codes to replace the existing labels on vials would reinforce the system by making it more difficult for intruders to identify the pathogens.

Regional anti-plague stations, which store pathogens for six months to a year before transferring them to an anti-plague institute, require a lower level of security, primarily composed of secured refrigerators and alarm systems. A computerized accounting system might be useful but not necessary. If the facility is not located in an area that presents specific security concerns, introducing an access-restricting system such as magnetic card access and secure storage for accounting logs will be sufficient.

An even lower security level may be envisioned for stations located at driving distance from the central institutes by providing vehicles and allowing more frequent transfers. Field stations, which store pathogens from a few days to a few weeks, primarily need equipment to secure the pathogens for short periods and during transfers. Local governments may also find innovative solutions to reduce the threat associated with pathogen collections.

In Kazakhstan, for instance, all dangerous pathogens will be consolidated at the central institute. Regional stations will receive simulants instead to conduct their research work. Such an approach, however, means more frequent transfers of pathogens from regional sites, making secure transfer imperative.

The location of a facility will also affect the type and level of security upgrades. One located in an area where major illicit trafficking occurs regularly, such as in the south of Kazakhstan, or with terrorist activity nearby obviously requires a higher level of security. Similarly, facilities monitoring particularly active natural foci also require a higher degree of security, as they isolate and store a larger number of strains each year.

Reinforcing the chain of pathogen custody during field work and transfers is also an essential task. This can be achieved by providing Global Positioning System receivers, satellite phones, and all-terrain vehicles to enhance secure transportation and foster continuous communications between teams in the field and their facilities.

A second priority is the prevention of brain drain. In this regard, it is important to involve anti-plague specialists in inter national cooperation projects that will not only support them financially but also use their knowledge to benefit the international community. It is important to engage scientists and technicians who have contributed to the Soviet biological weapons program as well as other anti-plague specialists who, without working on biological weapons programs, still have years of unique knowledge and experience working with dangerous pathogens.

Disease surveillance is also vital. European countries in particular should contribute to such efforts since an epidemic in these states would most likely spread to Europe, as shown by the avian flu and SARS out breaks recently. In addition, European countries could strengthen the alert and response system by establishing telephone lines to reach local hospitals and doctors in isolated areas. Supporting information campaigns for the local population living on natural foci and training local doctors to recognize the symptoms of endemic dangerous diseases would also improve disease surveillance. These activities were in Soviet times part of the anti-plague system's duties. Today, however, very few facilities have maintained such activities because of the lack of funding.

Using the experience of Soviet-era rapid response teams would also help in the fight against bioterrorism. Their training in identifying the source of an outbreak quickly and deploying an appropriate response would certainly improve the level of preparedness for such events whether in the United States, Europe, or the former Soviet states.

Besides security upgrades and brain drain prevention, improving laboratory equipment is essential in order to mitigate the consequences of laboratory incidents. Ventilation systems at anti-plague facilities conducting research on dangerous pathogens—regional stations and anti-plague institutes—are desperately needed, especially those located in residential or urban centers. Today, researchers sometimes work with open windows due to the absence of ventilation or air conditioning systems. Upgrades, however, should not lead to excessive reliance on technology. Soviet-era methods, emphasizing rigorous and technique-driven training, should be maintained and encouraged to ensure biosafety.

In these three priority areas, the definition of each anti-plague facility's needs should be the result of discussions among anti-plague representatives; their supervising agency, usually the Ministry of Health; and donor countries. The involvement of health organizations from donor countries in the process is critical to inject a dose of realism in host government expectations, by discussing sustainable options that address both security and public health concerns. Particular national requirements should also be taken into account while identifying present and future needs.

To reinforce security, steps should be taken to establish systems for managing back ground security checks. anti-plague specialists should also be educated on proliferation issues and ethics. The Department of State Bio Industry Initiative sponsors such training programs for scientists employed at facilities with Bio Industry Initiative-funded projects; these programs could be extended to anti-plague specialists.

Finally, it is essential to engage Russian anti-plague facilities that still remain closed to international cooperation. Europe and Canada may be better suited to do this because the Defense Department sharply decreased its biological weapons nonproliferation programs in Russia due primarily to failure to sign an implementing agreement with Moscow.

In the end, implementing cooperative threat reduction measures to deal with the former Soviet anti-plague system is necessary but not sufficient to cope with the system's complex dual-use nature. From the outset, the U.S. CTR program has acted in a fireman capacity by trying to put out the most urgent proliferation fires. To be sure, the system merits the CTR program's attention with respect to securing and consolidating dangerous pathogens, preventing their diversion, and forestalling brain drain. Yet, the anti-plague system differs fundamentally from other threat reduction challenges in that it has had and still assumes a critically important public health role. This capacity desperately needs to be sharpened if the international community is effectively to cope with the prospects of future and perhaps global epidemics.

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ENDNOTES

1. Animal diseases that can be transmitted to humans.

2. The exception being the Volgograd Institute, which worked exclusively on the biological weapons program.

3. In many cases, the facilities were given new names and sometimes merged with other public health organizations. For simplicity's sake, we will refer to them here as anti-plague facilities.

4. Sonia Ben Ouagrham, "Proliferation Threat From Former Biological Weapons Facilities in the FSU," The Liechtenstein Institute for Self-Determination, Princeton University, 2003.

5. A natural focus is considered "active" when strains have been isolated during the previous monitoring campaigns. The activity of a natural focus is cyclical; the bacteria or virus may appear as dormant for several years and then become active again. It is therefore important to consider the data for a number of years to determine the activity level of a focus.