Biological Weapons: The Impact of New Technologies

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Summary

Bioweapons have often remained a less debated subject in global dialogue as compared to other weapons of mass destruction. However, the recent development in technologies have lowered the barriers of designing new bioweapons and resurrected the threat of biowarfare. This has culminated in increasing recognition of such weapons in the global intelligence community and a review of existing regulations to ensure one remains updated to tackle with the renewed biological weapons threat. India is also vulnerable to biological attacks given the poor primary healthcare network, conducive environment and conflicting relations with neighbouring countries.

In June 2018, German police arrested a Tunisian man in Cologne for trying to build a biological weapon using the deadly toxin, ricin.[1] In October 2018, researchers flagged a US agricultural program funded by DARPA (Defense Advanced Research Projects Agency) as a potential mask for a bioweapons project.[2] At the same time, Russia also claimed that the US had tested biological weapons in Georgia killing over 70 people.[3] Further, suspect packages were sent to select targets in the United States in October 2018;[4] these packages in addition to being mail bombs also carried a white powder reprising concerns of the anthrax attacks from 2001 which led to the death of 5 people.

There has been no incident of biological agents being used as a weapon of mass destruction in the recent past. Yet as the above examples show, there have been attempts to explore and create technologies that could be weaponised by both state and non-state actors. The threat was made apparent by James Clapper, US Director of National Intelligence, who added gene editing in their annual worldwide threat assessment report in 2016.[5] Since then, there has been a wider recognition that the advances in technologies and improved access to science have lowered the barriers to creating designer bioweapons.

New technologies and Bioweapons[6]:

Gene editing using the recently discovered CRISPR/Cas system allows precise editing at a relatively cheaper rate without any high-cost expert training. It is important to note that before gene editing if any bioterrorist wanted to use a pathogen, he/she would have to obtain the pathogen from a restricted source. In many cases of bioweapons use, such as the one in Oregon where followers of Osho Rajneeshee, intentionally poisoned

civilians using Salmonella, these pathogens are obtained from scientific laboratories which hold these microbes for research purposes.[7] Over the past many decades, the instillation of Good Lab Practices and Biosafety standards have prevented the accidental release of these agents for malicious purposes. However, with the advances in gene editing techniques, bioterrorists could now use a relatively harmless biological agent and convert it into a more harmful agent. For instance, the currently available vaccines that protect against measles render the pathogen ineffective in causing the disease. However, the measles pathogen can be genetically edited such that it is no longer resistant to the vaccine. The resulting pathogen could easily wreak havoc even among a vaccinated population.

Other synthetic biology techniques could also be used to create pathogens without the necessity of getting any organic backbone. In 2002, scientists claimed the creation of the entire polio virus from scratch and the genome sequence was put in the public domain.[8] While such an endeavour needs scientific expertise and infrastructure, the public revelation of the methodology and genetic sequence certainly lowers the barriers to anyone attempting to design a similar agent. Another development has been the availability of large data sets of scientific knowledge and the AI (Artificial Intelligence)-driven processing powers that can help identify combinations of genes to specifically tailor a bioweapon against a target. Furthermore, as the scientific community shifts towards a more open access policy to make science freely available, the same knowledge could be easily available as well as accessible by terrorists.

There are 3 fundamental ways in which these technologies - either alone or in combination -could change the face of biowarfare:

1. **Creation of bioweapons that do not impact self forces:** This is exemplified by the vaccine-resistant measles case mentioned earlier. New diseases that one's own forces are protected against can be designed for warfare.

2. **Creation of agricultural pests:** Similar methodologies can be used to engineer bio-agents against agricultural targets, crippling the economy of the enemy nation or starving their population.

3. **Creation of tailored weapons:** Using advanced genetic knowledge, bioweapons capable of targeting single individuals or ethnic groups may be created. The use of a bioweapon of this variety may go unnoticed as an intentional attack and state parties may prefer such a weapon to avert large-scale conflict with an enemy state.

The renewed attention towards biological weapons and the relative ease to procure and stock them as compared with traditional weapons of mass destruction may also entice non-state actors into acquiring and using bioweapons.

In the context of this changing scenario of bioweapons use, existing regulations helmed by the Biological Weapons Convention (BWC) are severely inadequate in restraining the proliferation of these new technologies.

Current Status of Biological Weapons Convention

The BWC, which have been in effect since 1975 has been repeatedly criticised for its ambiguous language and more importantly, for the lack of a verification mechanism that can be invoked to check if signatory nations are complying with its mandate. The Convention prevents the creation, use,

stockpiling or exchange of any bioweapon; however, its very definition of "bioweapon" is ambiguous. It allows the stocking of pathogenic agents in small quantities that can be used for peaceful purposes. Scientists, for example, hold small repositories of pathogenic agents to research better diagnostic or therapeutic interventions. However, unlike nuclear or chemical weapons, small repositories of biological agents can be easily scaled up for malicious purposes. This makes identifying the intention behind holding biological agents in any quantity difficult and defeats the purpose of the Convention.

The BWC's repeated attempts to introduce an effective verification mechanism have failed and as many as 12 countries including Iraq, Iran, Libya, China, Russia, and North Korea, who are parties to the Convention, are often alleged to have an ongoing bioweapons programme.[9] An incident in Russia revealed that they held on to their exploration bioweapons programme much after ratifying their commitment to the BWC.[10] Notably, Israel is not a signatory to the Convention stoking fears that the nation may be experimenting with bioweapons.[11]

The 2018 BWC Meeting of Experts held in Geneva in August also noted the implications of gene editing advances to the areas of biowarfare and the need for its regulation.[12] China and Pakistan proposed a voluntary model code of conduct for scientists engaged in using biotechnology. France and India proposed the formation of a database where aid requirements could be matched with specific offers of assistance. But more pertinently, the December BWC review conference brought to notice the dismal funding situation of the BWC but did not reach a consensus on adopting any of the measures suggested by the Experts meeting.[13]

Yet there has not been a significant incident post World War II where bioweapons have been used as a weapon of mass destruction. This success may not be a fall out of the BWC but could be attributed to the nature of bioweapons: they are difficult to control, unreliable and cannot distinguish between self and non-self forces. Further, there was fear of usurpation of the technology by non-state actors. However, with the advent of new technologies discussed earlier, many of these limitations have now been removed. As a consequence, the threat of a bioweapons attack has become very real and India needs to take steps to protect itself from such an attack.

Policy recommendations for India[14]

India's weak primary healthcare system (as stated in a report where the country ranks 145 among 195 countries in healthcare access),[15] conducive environment[16] and hostile relations with neighbouring countries leave India vulnerable to a biological attack. Such an attack might aim at decreasing productivity in India by affecting its people or hampering agriculture or other natural resources such as water. India needs to develop a strong biodefense programme to shield itself against any bio- attack.

1. Surveillance Mechanisms

A primary focus has to be on creating grassroot-level infrastructure and linkages to implement real-time surveillance mechanisms that can rapidly detect a biological outbreak and trigger a swift response from the appropriate authorities. This holds true for both human and agricultural attacks. Improved point-of-care diagnostics will aid in real-time surveillance. A staggered chain of protocols, including quarantine, personal protection equipment for healthcare workers, sample collection and delivery should occur in response to an

infectious outbreak – particularly for those cases where a disease cannot be easily identified.

In many cases, an antibody or specific DNA based tests are used for diagnosis. However, the sequencing of the entire DNA would help identify if the agent has been tampered with using artificial agents. Though this is not always reliable, treating unusual cases as a likely bioweapons attack and documenting genome sequences of the biological agent would provide a repository that could lend useful information for future use.

2. Biosafety Standards, Ethics, and Penalties

The adoption of biosafety standards in all academic and private laboratories and its enforcement through the instillation of penalties for violations will reduce accidental leakages of biological agents from authorised laboratories. The inclusion of ethics in school and college level curriculum, as well as orientation of new hires in laboratories, is essential to educate about the responsibility of the individual researcher with respect to the biological material they are using.

3. Leader at the Biological Weapons Convention

India needs to take a leadership position at the BWC and facilitate the inclusion of the following:

a. A scientific advisory board: Unlike the Chemical Weapons Convention, the BWC does not have a scientific advisory board to advise on new trends in biotechnology and ways to counter the new age bioweapons. The formation of such a board would aid the Convention to make pragmatic decisions to prevent the proliferation of bioweapons.

b. Funding issues: Lack of funding and infrastructure has long ailed the BWC. The implementation support unit of BWC consists of 3 individuals and is sorely under-staffed.[17] India could work with other countries in ensuring the BWC has enough funds to carry out its designated roles.

c. An alternative to the verification mechanism: While verification is deemed a political non-starter at the BWC, India could partner with other countries for creating a more co-operative mechanism that could be used to transfer important technology for vaccine production or improved vaccine manufacture.

d. India could also push for transforming the voluntary system for reporting on national activities to a mandatory reporting. The current voluntary confidence-building measures require member parties to voluntarily exchange information on vaccine production plants, biodefence programs, and unusual disease outbreaks. However, this system has seen low active participation; from 1987 to 1995, only 70 of the then 139 member states of the BWC submitted data declarations, and only 11 took part in all rounds of the information exchange.[18] In addition to mandatory reporting, penalties can be put in for parties who are not compliant with the confidence building measures dictated by the BWC. This will help India to gain access to technologies that could improve India's primary health care response.

4. Treaties with Other Nations

Within and outside the BWC, India needs to forge strategic partnerships with countries who can share their expertise on biosecurity.

5. Public Engagement

India needs to embark on a public engagement dialogue to educate its

population about the threat of infectious outbreaks and how to respond in case of any outbreak. An unusual outbreak can easily cause panic amongst people and may aid in spreading the disease as people move away from the epicentre of the attack.

Conclusion

The threat of a bioweapons attack is swiftly being recognised by countries worldwide and India also needs to step up its biodefense programmes. While new technologies may lower barriers of acquiring biological weapons, the renewed attention the topic is getting may itself be sufficient to get non-state actors interested in experimenting with such weapons. Improved access to scientific knowledge, easier control over biological material and reduced cost of creating designer pathogens could entice state and non-state actors to experiment with biological weapons. The current regulatory architecture led by the Biological Weapons Convention may be inadequate to contain this threat and needs to be revisited. India, in particular, needs to focus on national and international measures that can be taken to curtail the threat of bioweapons. A networked primary healthcare system, strong collaboration with other countries and public engagement are central to protecting India from an infectious outbreak – may it be intentional or natural.

Endnotes:

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