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Smallpox Revisited?

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Abstract
This article reviews the history of smallpox and ethical issues that arise with its threat as a biological weapon.[1] Smallpox killed more people than any infectious disease in history-and perhaps three times more people in the 20th Century than were killed by all the wars of that period. Following a WHO-sponsored global vaccination campaign, smallpox was officially declared eradicated in 1980. It has since been revealed that the Soviet Union, until its fall in the early 1990s, manufactured tens of tons of smallpox for military purposes. A worry is that some of this may have fallen into the hands of "rogue" nations or terrorists. Current U.S. debate questions whether smallpox vaccine should therefore be made available to the American public, which-like the rest of the world-now lacks immunity. Because the vaccine is considerably dangerous, public dialogue cannot resolve this matter if evidence material to the likelihood of attack is classified (i.e. secret). I conclude by recommending numerous future areas for ethics research related to the weaponization of smallpox.

I. History

Death Toll

Smallpox is one of the most dreaded diseases. Caused by the variola virus, it allegedly killed more people in history than any other infectious disease. In the 20th Century alone it killed an estimated 300 to 540 million people-"more than all the wars and epidemics [of that century] combined" (Miller et al. 2001, 58). According to Michael Oldstone, smallpox killed three times more people during the 20th Century than were killed by all the wars of that period (Oldstone 1998, 3).

Symptoms of smallpox include fever, headache, backache, nausea, and puss-filled boils on the mouth, face, and body (Tucker 2001). Victims suffer excruciating pain. A third of those infected are killed; survivors are left scarred and often blinded. Spreading in airborne droplets-or by contamination of clothing, blankets, and so on-the virus is highly contagious.

The vulnerability of populations lacking immunity to smallpox is illustrated by the conquest of Mexico and Peru by Spanish invaders. In the 1500s, with an army of only 500 men, Hernando Cortes conquered the Aztec empire's population of 12.5 million people. His success owed much to the devastation caused by the (unintentional) importation of smallpox. Most Spanish soldiers were immune, having survived childhood bouts with the disease in Europe where smallpox was already endemic.[2] Native Americans, on the other hand, lacking immunity because never previously exposed to the virus, were decimated by widespread epidemics. Smallpox likewise assisted Pizarro in Peru. "During the time of the Spanish conquest in the New World it is estimated that more than one-third of the total native population had been killed by smallpox virus" (Oldstone 1998, 4, 31-33; Tucker 2001, 9-13).

Previous Military Use

The danger of smallpox to "virgin" populations has perhaps more than once been purposely exploited by military leaders. To quell uprisings in the American colonies after the French and Indian War, for example, the British Army apparently provided smallpox-infected blankets to Indians. Sir Jeffrey Amherst, the British commander-in-chief in North America, famously made the request:

> 'Could it not be contrived to Send the Small Pox among those Disaffected Tribes of Indians? … We must, on this occasion, Use Every Stratagem in our power to Reduce them.' In response to Amherst's recommendation, [Colonel] Bouquet replied … 'I will try to inoculate … by means of some blankets that may fall in their Hands, taking care however not to get the disease myself' (Tucker 2001, 20).

The British were later also accused, by the Continental army, of intentionally spreading smallpox during the American Revolutionary War.[3]

Vaccination and Eradication

The medical history of smallpox is equally noteworthy. A primitive form of vaccination, called variolation, already existed 3000 years ago in India. Inoculation with puss or material from scabs of smallpox survivors, or those recovering from mild disease, was used as a method of inducing immunity. (One form of variolation involved the snorting of powder from ground-up scabs.) Variolation was introduced to England and the United States in the beginning of the 18th Century. For a number of reasons the method was controversial. It could, for example, itself spark epidemics (Tucker 2001, 15-17). The prevalence of the practice therefore varied.

The first true vaccine was discovered by Edward Jenner in England in 1796. In an experiment that would be considered ethically problematic by today's standards, Jenner found that injection of cowpox puss provided smallpox immunity to an eight-year-old boy subsequently injected with the smallpox virus. As a reward for cooperation, Jenner provided the young man with a house 22 years later (Tucker 2001).

During the second half of the 20th Century a derivative of Jenner's vaccine was employed in the World Health Organization smallpox eradication campaign, led by D. A.

Henderson. Following massive global vaccination efforts-especially in Africa and Asia where smallpox continued to be a problem-the disease was completely stamped out. The last (reported) "natural" case occurred in Somalia in 1977. The last (reported) human case resulted from unsafe medical research in England in 1978. In 1980 the World Health Organization declared smallpox officially eradicated. This is one of the great success stories of modern medicine.

Upon eradication it was decided that all remaining samples of the smallpox virus would be held under tight security at two facilities-the Centers for Disease Control and Prevention, in Atlanta, and the Ivanovsky Institute of Virology, in Moscow. It was planned that the samples would all eventually be destroyed. The plans for destruction, however, were subsequently and repeatedly postponed.[4]

Tons of Smallpox Manufactured by Soviet Military

This is largely because it has more recently come to light that the Soviet Union, until its fall in the early 1990s, manufactured and stored tens of tons of smallpox for military purposes. The scope of the Soviet biological weapons program, called "Biopreparat," was enormous, employing 30,000 to 60,000 scientists. As well as smallpox, the Soviets weaponized and produced numerous other deadly microbes and toxins. At peak levels, they had the industrial capacity to produce 1,500 metric tons of tularemia, 4,500 metric tons of anthrax, 150 metric tons of the plague, 100 metric tons of smallpox, 2,000 metric tons of glanders, and 250 metric tons of Marburg virus yearly (Miller et al. 2001, 254). In addition to loading intercontinental ballistic missiles with smallpox, the Soviets aimed to genetically engineer more dangerous strains of disease. One project pursued creation of a "chimera" hybrid of smallpox and ebola. A microbe combining the virulence of the former with the fatality of the latter would be daunting if successfully developed. According to Ken Alibek who was deputy director of Biopreparat from 1988 until 1992, when he defected to the United States and began briefing American intelligence agencies, the Soviets succeeded in developing a "genetically altered strain of anthrax resistant to five antibiotics" and a strain of plague resistant to "practically all antibiotic treatments" (Alibek 1999, 163, 167). Although their weapons stock of smallpox is supposed to have since been destroyed, this has never been verified. Alibek believes that Russian smallpox weapons development continues to this day (Alibek 1999, 263).

Given that the Soviet Union initiated the idea of global smallpox eradication to begin with, it is especially disturbing that they dramatically increased military production of the virus once eradication was accomplished. In addition to breaching the 1972 Biological and Toxin Weapons Convention, this should be condemned as a betrayal of the many people and countries that cooperated in the eradication effort (Tucker 2001) and, perhaps, a crime against humanity.

Bioterrorist Threat

Because routine smallpox vaccination ended in the United States in the early 1970s, and worldwide by the early 80s after eradication was declared, the world population as a whole is now extremely susceptible to the disease. The majority of the global population has never been vaccinated; and, the immunity of those who were vaccinated decades ago is believed to have worn off. (Boosters are recommended every ten years to maintain immunity.) In many ways the world population as a whole is in a situation similar, in its vulnerability to smallpox, to that of the Aztecs and Incas when the Spanish arrived in the 16th Century.[5]

American scientists and governmental leaders now worry that the military supply of Soviet smallpox was less well guarded (than the official samples) and that the virus may thus have fallen into the hands of "rogue" nations or terrorist organizations. Of particular concern is the fact that Biopreparat scientists (who formerly had relatively lucrative jobs) have been poorly paid-and sometimes unpaid-since the Soviet collapse and might therefore have financial (if not political) incentive to sell their expertise and any dangerous microbes they might have access to. It is known that Iran has tried to recruit such scientists (Miller et al. 2001). The whereabouts of many, or most, former Soviet bioweaponeers is, in any case, unknown. Smallpox-loaded intercontinental ballistic missiles are likewise unaccounted for. According to one American government scientist, "The Russians themselves have told us that they lost control of their smallpox. They aren't sure where it went, but they think that it migrated to North Korea … we think it happened around 1991, right when the Soviet Union was [falling]" (Preston 2002, 95).

An additional concern is that other countries may have saved secret stocks of smallpox all along. According to a Washington Post report of intelligence leaks, the CIA believes that "four nations-Iraq, North Korea, Russia and … [even] France-have undeclared samples of the smallpox virus." Iraq is under suspicion partly because of evidence that Iraqi prisoners of the Gulf War had been recently vaccinated for smallpox, and also because one of the last known epidemics of the disease occurred in Iraq in the early 1970's. "The WINPAC report assessed that Iraq 'retained samples from the 1971 outbreak.'" According to one official, speaking about Iraq and North Korea: "'The assessment is, they have it.' … 'We don't say 70 percent certainty. We assess that they have it.'" The Post further reports that "Osama bin Laden devoted money and personnel to pursue smallpox, among other biological weapons … [but an] authoritative official said there is 'no reason' to believe [he] succeeded in obtaining the smallpox pathogen. Bin Laden's efforts are significant chiefly because U.S. policymakers believe he would use it" (Gellman 2002).

If smallpox is used as a weapon the effects could be catastrophic. In light of dwindling worldwide immunity, experts warn that a bioterrorist attack could trigger a global epidemic (Broad 2001). Modeling of potential smallpox attacks has shown the destruction expected by (perhaps a series of) nuclear attacks(s).

Vaccine Supply

To make matters worse, the global supply of smallpox vaccine is low. In 1980 WHO had 200 million doses. Because these were expensive to store and maintain, by 1990 all but 500,000 were destroyed as a cost saving measure. Worldwide stocks of vaccine then amounted to only 50 million viable doses (Tucker 2001, 243).

In response to the World Trade Center destruction and the anthrax attacks that followed-and in preparation for anticipated war with Iraq-the American government has been building a supply of vaccine and planning its distribution. As of September 11, 2001, the United States had only 15 million doses. It has since acquired an additional 85 million doses found frozen, and donated, by a pharmaceutical company (Gillis 2002). Because these can be diluted, there is now enough on hand to protect the American population of approximately 300 million. Additional new doses have, in the meantime, been ordered. Except for South Africa, Israel, Britain, and Germany, vaccine stocks in other countries are low.

II. Vaccination Policy Debate

Pre-Versus Post-Attack Planning

U.S. government vaccination policy deliberations have been the subject of high profile American newspaper attention in recent months. Although controversial, CDC (Centers for Disease Control and Prevention) guidelines about what should happen in the event of a smallpox attack have received comparatively little publicity. Post-attack plans are to employ the strategy (similar to that employed in the eradication campaign) of "ring" vaccination of contacts-and contacts of contacts-of those infected, and perhaps mass vaccination of entire regions if necessary.

Most media attention has focused on the question of who should receive smallpox vaccine in the "pre-attack" scenario. The immediate plan, recently announced by George W. Bush, is to vaccinate (on a voluntary basis) 500,000 domestic health care workers and emergency personnel-i.e. "first-responders," or those most likely to come into contact with smallpox patients if the disease is released-and 500,000 military personnel (for whom vaccination is mandatory). Following this initial phase, the vaccine will be offered to an additional 10 million health care and emergency workers. It is being debated, in the meantime, whether or not vaccine should also be made available to the general public on a voluntary basis prior to the event of attack.

Vaccine Danger

Public availability of smallpox vaccine is controversial because the vaccine is made from a live virus called vaccinia which is closely related to the smallpox virus (i.e. variola) and is itself considerably dangerous.[6] Of all vaccines, it has one of the highest rates of complications-including death, disability, scarring, and minor morbidity (Engler et al. 2002, 358). "For every million people vaccinated, 15 suffer life threatening complications like encephalitis, and 1 or 2 of the 15 die. Hundreds of others suffer serious skin rashes, infections, and other problems, based on studies done before 1972, when the vaccination was routine in the United States" (Grady 2002a). Routine vaccination was terminated upon eradication precisely in order to avoid unnecessary mortality: while continued vaccination caused significant numbers of deaths, the disease itself was no longer a problem.

In addition to harming those who are vaccinated, the site of smallpox vaccination can be infectious, and sometimes deadly, to third parties for two to three weeks after the time of inoculation.[7] Persons with skin disorders such as eczema and atopic dermatitis, pregnant women, and those with weakened immune systems-as a result of AIDS, organ transplantation therapy, or cancer treatment-are especially vulnerable to infection from their own or other people's vaccinations. (In the pre-attack scenario anyway, individuals known to have such conditions would not themselves be offered vaccination.) Of particular concern is that so many more people have eczema and weakened immune systems now, compared to 30 years ago when routine smallpox vaccination ended in the United States and when AIDS, for example, was completely unknown. For mysterious reasons, "eczema is two to three times as common as in the past" (Grady and Altman 2002).

The magnitude of vaccine danger to those with HIV/AIDS is poorly understood. There is only one known "case in which a person with H.I.V. was given a smallpox vaccination. The patient was a 19-year-old soldier who did not know he had H.I.V. when the military vaccinated him in 1984. He developed progressive vaccinia [which is untreatable] and AIDS, and died." In light of this scenario, the fact that the CDC "estimates that 300,000 Americans have H.I.V. and do not know it" (Grady and Altman 2002) is a serious problem.

The Case Against Public Vaccination

Those who oppose vaccination of the general public argue that this would cause unnecessary mortality. While the danger of a smallpox release is a mere possibility, a significant number of deaths are certain to result from widespread vaccination. Even when those with counter-indications are excluded, hundreds of lives would be lost from widespread vaccination of the American public. A recent study "estimated that if 60 percent of Americans were immunized, 482 people would die from side effects of the vaccine (Grady 2002c). Critics note that this would cause more killing "than any terrorist attack save that of September 11th" (Gellman 2002). Given uncertainties about the safety of vaccination in the current context, mortality could turn out to be higher than estimated. Given that smallpox itself is not killing anyone now, and has not killed anyone for 25 years, why initiate a deadly practice without having solid reasons for believing attack is forthcoming? Some say that a policy of public vaccination would be reminiscent of the Swine Flu fiasco during the early 1970s-when a government sponsored vaccination program caused sickness and death while the Swine Flu itself, in retrospect at least, was not a real threat.[8]

The Case for Public Vaccination

Proponents of the public availability of vaccine, on the other hand, argue that people should be free to make their own choices and take their own risks as they see fit. If informed individuals understand the risks of vaccination and voluntarily choose to take them, then why should they be prevented from doing so? William Bicknell argues that "a survey has shown that 61 percent of Americans would want to be vaccinated if smallpox vaccine were available, and the public thus appears to be ready for this approach" (Bicknell 2002, 1323).

Given the enormous logistical difficulties of managing an epidemic and vaccinating millions of people quickly, as may be required if smallpox attack ensues, Bicknell further argues that it would be more feasible to vaccinate people ahead of time without all the rush, panic, and chaos that would follow an attack. If more people are vaccinated ahead of time, then the post-attack vaccination program would be logistically facilitated as well-because fewer people would remain who need to be vaccinated quickly. Modeling has shown that a smallpox attack on an American population lacking immunity would be exceedingly difficult to contain in the contemporary world of mass transit. Draconian measures such as quarantine would likely be implemented-and even these may fail to prevent the spread of disease. Because the impact of attack would largely be a function of the speed at which the attack is recognized, the speed at which infected persons are identified, and the speed at which vast numbers of people are vaccinated, a worry is that the American public health care system is inadequately prepared to prevent disaster. Although there has been a recent influx of funding, the public health care system was woefully under-resourced for decades (Garrett 2000). Finally, Bicknell argues that vaccination of the public could deter a smallpox attack to begin with. The more people vaccinated ahead of time, the less effective a smallpox attack would be, and the less motivation there would be for launching one.

Complications

Controversy is complicated by the fact that (much of the) existing vaccine, because of its age and dilution, is officially classified as "investigational" by the US FDA (Food and Drug Administration).[9] New vaccine currently being manufactured through advanced production methods will likewise need to be tested and licensed. Anyone vaccinated with "investigational" vaccine-and perhaps third parties exposed to them-will in effect be experimental subjects. Since the danger of vaccine to third parties in today's world is presumably one of the things that needs to be determined, it would seem that those potentially vulnerable to the vaccinations of others should themselves be asked for consent to experimental participation. They would otherwise be unwitting subjects in research that puts them at risk. It is hard to imagine, however, how the consent of all those potentially endangered by the vaccinations of others could in practice be obtained. (Questions of liability in the case of third party infection would, anyway, be difficult if vaccine is eventually offered to the general public (Altman 2002). Protective patches over inoculation sites will provide one way of reducing third party infection.) The experimental nature of the vaccine also makes the vaccination of children, who cannot provide informed consent to research participation, especially problematic (McNeil 2002). Another concern is that VIG (vaccinia immune globulin), which is used to treat some complications of vaccination, is currently is very short supply.

The Case for Intelligence Briefing

Leaving questions about the experimental nature of the vaccine, and worries about third party infection, to the side, the question of whether or not smallpox vaccination, once tested and licensed, should be offered to the general public on a voluntary basis is difficult. Although Anthony Fauci has encouraged "public debate" on this matter (Fauci 2002), I elsewhere argue that meaningful debate is not possible if information required to settle the issue is classified (i.e. kept secret by the intelligence community).[10] The merit of voluntary mass vaccination depends on the likelihood that smallpox will be used as a weapon against the United States. If the probability of attack is 100%, then mass vaccination is surely advised. From a societal standpoint, the lives lost to vaccination would be compensated by the presumably much larger number of lives that will be saved from smallpox. If the probability of attack is close enough to zero, on the other hand, then mass vaccination would be wrong, because the loss of life to vaccination would be unnecessary. If all we are told is that the chance of attack is somewhere between zero and 100%, then we can do nothing but scratch our heads. Without at least narrowing the range of possibilities, we cannot begin to assess the utilitarian rationale (for public "pre-attack" vaccination) offered by Bicknell, for example. Is the loss of life to vaccine worth the reduction in risk of attack? That all depends on the likelihood of attack to begin with.

I assume that the intelligence and military communities attach a probability, or at least a (narrower) range of probabilities, to the likelihood of attack. There is presumably, in any case, significant evidence about the likely possessions and intentions of various groups and countries that has not been shared with the general public. If the public is kept in the dark about expert assessments of the likelihood of attack, or important evidence there is for thinking there will or will not be an attack, Fauci's "public" debate can never get off the ground.

Some might argue that no more information is needed to settle the question of whether or not vaccine should be made available to the general public, because individuals should be free to make their own decisions about whether or not they want to be vaccinated, in light of awareness of the benefits and risks of vaccination, in accordance with their own risk taking strategies. To deny this is to advocate paternalism.

The response to this objection is twofold. First, paternalism in the context of medicine is already a widely accepted practice insofar as drug license and use requires both FDA approval and physician's prescription respectively. Informed individuals are not, generally speaking, permitted to take whatever dangerous drugs they might choose. Doctors and regulatory bodies prevent them from doing so-for their own good. The ideology behind the objection is thus revisionary.

Second, and more importantly, if the rationale for voluntary vaccination is supposed to be provided by the importance of informed individual decision making, rather than other utilitarian considerations discussed by Bicknell, then disclosure of (good information about) the likelihood of attack is needed. One cannot make an informed choice of vaccination over no-vaccination, or vice-versa, unless aware of both the risks of vaccination and the risks of remaining unvaccinated. For an individual to make an informed choice she would need to be presented with information about the likelihood of an attack, the likelihood that she would in fact be infected in the event of an attack, and the likelihood that should would die (or be scarred and/or blinded) if infected. If informed voluntary decision making carries the weight, then not only should more (presumably classified) information about the likelihood of an attack be released in the public domain, but direct explanations should be provided (in consultation and/or consent forms) to those offered vaccination. Recent studies indicate that the general American public currently has a very poor understanding of smallpox and its history (Manning 2002).

Both public deliberation and private deliberation thus require intelligence briefing. We cannot, of course, expect that everything known about the danger of a smallpox attack should be revealed to the general public. Public disclosure of sensitive information about the possessions and intentions of potentially hostile groups and countries could jeopardize national security in numerous ways. A balance should be struck, however, between the maximal promotion of security, on the one hand, and the facilitation of public and private deliberation on the other. The fact that intelligence agencies left the American people (and many governmental leaders) in the dark about the scope of the Soviet weapons program for seven years, and then left it up to a former Soviet bioweaponeer (i.e. Ken Alibek) to go public, is cause for concern if smallpox vaccination policy is to be settled through transparent democratic processes.[11]

III. Future Research

Human Subjects

Given that the historical and potential future consequences of smallpox are almost unrivalled, the topic in general is worthy of more ethical discussion. The smallpox story makes a good case study. Should we retrospectively condemn, for example, Jenner's experiment with the young boy despite the facts that (1) Jenner (in light of variolation and the fact that milkmaids remained free of smallpox) presumably had good reasons for believing that his experiment would work, (2) the boy remained unharmed and furthermore benefited from both smallpox immunity (perhaps vindicating Jenner's confidence) and the gift of a house, and (3) the experiment enabled the eradication of humanity's most deadly scourge? Jenner's experiment led to one of medicine's greatest successes. It is hard to say what a utilitarian condemnation of Jenner would look like. Should utilitarians advocate that relevantly similar research with willing young-ones be permitted at present? What should nonutilitarians say about the example?

Professional Ethics

Smallpox weaponization raises issues of its own. What should be said, for example, about the morality of bioweapons research in general-especially when agents like smallpox are involved? How is this different, from an ethical standpoint, from conventional or nuclear weapons development? Assuming a case for the moral prohibition of biological weapons development can be made, the more difficult question will ask how to prevent their development in practice. The stories of Ken Alibek (of Biopreparat) and William Patrick (who worked in offensive biological weapons development in the United States until this was banned by President Richard Nixon in 1969) are remarkably similar. They both say that they didn't really think too much about the ethics of what they were doing. They believed that enemies were probably up to similar tricks and that everything should be done to protect the homeland. They were interested in science and (at least in Alibek's case) career advancement.[12] Providing an ethical argument against biological weapons research would be one thing, but developing a practical strategy for preventing this kind of mentality in practice is something different. Bioethicists should think about both.

Genetics

A related question asks how much scrutiny should be placed on the conduct and publishing of research with clear weapons development implications. American Scientists, for example, recently revealed how they succeeded in creating a "live" polio virus by joining commercially available sequences of DNA in accordance with the previously published map of the polio genome (Pollack 2002). The publishing of this kind of research, claim critics, provides terrorists and "rogue" nations with dangerous ideas and instructions. It doesn't take a great leap of biological imagination to realize that it might be possible to produce smallpox (whose genome has also already been published) or other dangerous microorganisms through similar methods. Admitting that it would be more difficult to create smallpox (whose genome is much larger than polio's), critics nonetheless claim that the gene is out of the bottle now that the research has been done and shared with the public. It might just be a matter of time, they say, until this (kind of) research comes back to haunt us.

Another controversial case involves the genetic engineering of mousepox. Australian researchers accidentally discovered, then published, that insertion of the IL-4 mouse gene into mousepox created a strain of mousepox that kills vaccinated mice (which would have been immune to ordinary mousepox). The methods of gene insertion were relatively simple (for microbiologists): instructions are provided in standard microbiology texts and no extravagant equipment is necessary. A frightening implication is the plausibility that vaccine-resistant smallpox (which is closely related to mousepox) might easily be produced by the very same methods-and that this has been advertised (Preston 2002).

Discourse on ethical, legal, and social implications of the human genome project, and other advances in the science of genetics, has paid too little attention to what could turn out to be the most dangerous aspect of the new genetics. While initial attention focused on the worry that dangerous genetic material might (result from recombinant research and) escape into the environment (Dutton 1988)-and issues related to eugenics, discrimination by employers and insurance companies, DNA fingerprinting, and so on (Kitcher 1996)-comparatively little attention has been paid to the relevance of genetics to weapons development. Increased ethical and democratic debate about whether or not-or how-to regulate research and publication (when there are weapons implications) is needed. While scientific freedom and freedom of speech are important, these should not automatically be given absolute priority over other social goals that might be threatened.[13]

Quarantine

Getting back to policy planning for a potential smallpox attack in the USA, the question of appropriate quarantine policy is controversial. It is widely agreed that existing quarantine legislation is outdated and in need of revision. In light of the increased bioterrorism threat and concerns about smallpox in particular, the CDC recently produced (a draft of) new guidelines. Providing state public health authorities with emergency authority over physicians and medical institutions, and power to enforce isolation and quarantine, the current document is criticized by George Annas for being overly draconian and likely to be counterproductive (Annas 2002). Joseph Barbera and colleagues argue that role players in biological attack modeling have often resorted to quarantine inappropriately (Barbera et al. 2002). While public health experts might best be qualified to settle the question of which policy would maximally promote public health, the question of how this utilitarian aim should be balanced against libertarian aims to protect privacy and freedom of movement, etc. requires ethical and legal discourse.

Distribution of Resources

The emergence of new infectious diseases (such as AIDS and numerous others), the re-emergence of old infectious diseases (such as tuberculosis), and the bioterrorist threat all provide good reasons for improving the public health care system in the United States (and elsewhere) (Garrett 1994, Garrett 2000). Recent influx of resources to the Department of Health and Human Services should thus be welcomed. Some are concerned, however, that too much attention and money will be directed to bioterrorism in general, and smallpox in particular, and that other important public health care services will remain marginalized. How much of the public health care budget should aim at prevention of smallpox rather than other things--like AIDS, other STDs, tuberculosis, and the flu? This will partly depend on the likelihood of biological attack with smallpox.

Smallpox aside, there are good reasons for thinking that a more global approach to public health is needed. It is widely acknowledged, for example, that the AIDS pandemic presents not only a global health threat, but also a global economic threat, and a global security threat. An unclassified CIA report titled "The Global Infectious Disease Threat and its Implications for the United States" points to a number of self-interested reasons for doing more to fight AIDS (in the developing world especially) and claims that the security threat from AIDS (which is currently destabilizing entire regions of Africa in particular) is real.[14] Biodefense is not the only domestic public health care need in the United States; and, nor is bioterrorism the only health related security threat to the United States. An appropriate distribution of resources between (1) biodefense, (2) other domestic public health care needs, and (3) global public heath is therefore wanted. Medical ethicists should be a part of this discussion.

Ethics and Infectious Disease

The story of smallpox also points to a broader area of ethical discourse. The historical consequences of infectious diseases were enormous; and, their future consequences (as evidenced by AIDS) are likely to be similar whether or not they are used as biological weapons. In virtue of the phenomena of contagion, and the emergence of drug-resistance, the topic of infectious disease raises ethical issues of its own. Finally, because infectious diseases predominantly affect the poor, the topic of infectious disease relates to the topic of justice (which has traditionally been a central concern of ethics). For these and other reasons it is surprising that the topic of infectious disease, in general, has not captured more attention of bioethicists (Selgelid 2002). This is fruitful ground for future research. Ethical thinking about infectious diseases more generally would, in any case, likely inform debate about their potential use as weapons.

Notes

1 I have benefited from discussion with, and research suggestions of, Richard Hatchett, MD, who additionally read a complete draft of this paper and provided useful suggestions. For research support, I thank (1) the Research Office and the Faculty of Health Sciences' Division of Bioethics at the University of the Witwatersrand, Johannesburg, South Africa, and (2) the Fundacion Seneca and the Philosophy Department of the University of Murcia, Murcia, Spain.

2 Children are more likely than adults to survive smallpox illness. See McNeil 1976.

3 The British Army, at the time, employed the practice of variolation (as

described below) in order to promote their own immunity (Tucker 2001, 21).

4 A cattle breeder apparently had already inoculated his wife with cowpox in 1774, twenty-two years before Jenner's experiment. Jenner is normally given credit for the "discovery" of vaccination, however, because he "engaged in systematic experimentation and … published his findings widely" (Tucker 2001, 24-27).

5 The current global population, however, may be somewhat more resistant to smallpox than were the Aztecs and Incas. There may be more human resistance to infectious diseases in general today, for example, as a result of natural selection and (at least for those who are relatively wealthy) improved nutrition, sanitation, and hygiene. See: McNeil 1976, McKeown 1988, Tomes 1998, and Dubos and Dubos 1952. Those vaccinated long ago may, furthermore, have at least some residual immunity. It is also "possible that modern drugs and treatments could save more lives than in past epidemics" (Broad. 2002).

6 It is often called "the most dangerous vaccine."

7 "According to a study of 11.8 million Americans in the 1960's, for every 100,000 people vaccinated for the first time, vaccinia spread to two to six others who had not been vaccinated. Most who caught the virus developed 'accidental infections,' sores that healed on their own. But one or two became very ill" (Grady 2002b).

8 Peter Lurie, in conversation. For history of the Swine Flu scare, see Garrett 1994.

9 Existing vaccine is 30 years old. It has been in storage since routine vaccination ended in the USA in 1972. The stocks planned for phase-one vaccination of first-responders have recently been licensed. In the immediate future, however, only investigational versions would be offered to the public.

10 See Selgelid 2003.

11 There are other examples of worrisome governmental precedent involving the failure to disclose intelligence related to vaccination policy: "In December 1997," for example, "six years after the Persian Gulf War, the Pentagon announced that it had decided to vaccinate its 2.4 million solders and reservists against anthrax. It was unclear what prompted the decision. Iraq's program to make biological weapons had been exposed more than two years earlier, and Clinton Administration officials offered no public assessment of what new dangers existed, if any" (Broad 2001)..

12 See Alibek 1999, and Miller et al. 2001.

13 See Kitcher 2001.

14Available from: http://www.odci.gov/cia/publications/nie/report/nie99-17d.html. Ironically (the unclassified version of) this study says relatively little about the threat of bioweapons in comparison with AIDS.

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