A Literature Review of How Programs and Policies Created in the Aftermath of the 2001 United States Anthrax Attack: Influence Public Health Readiness Responses

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The 2001 anthrax attacks, following the unprecedented events of September 11, 2001, served as a catalyst for transformative changes in United States emergency preparedness, public health policy, and interagency coordination. This literature review examines the historical evolution of bioterrorism response mechanisms—from the early vulnerabilities in detection and diagnosis to the comprehensive legislative and operational reforms enacted thereafter. Critical programs and policies, such as Project BioShield, the Strategic National Stockpile, and various surveillance networks, are analyzed to understand their role in enhancing countermeasure research, emergency response planning, and workforce capacity. The review highlights the interplay between political, scientific, and public health communities in shaping these interventions and underscores the persistent challenges related to regulatory gaps, funding constraints, and interagency communication.

Using academic, governmental, and peer-reviewed sources, this study evaluates the effectiveness of post-2001 initiatives in mitigating the impact of biological threats while identifying areas needing improvement. The findings reveal that while significant strides have been made in modernizing health security frameworks, ongoing issues, such as, the misuse of Emergency Use Authorizations, inequitable resource distribution, and workforce shortages pose risks to long-term public safety. Based on these insights, recommendations are provided to bolster future preparedness efforts, including enhanced funding, systematic policy evaluations, and strategies to expand and support the public health workforce. This review calls for continuous interdisciplinary collaboration and adaptive policy frameworks to ensure robust and resilient responses to emerging biological threats.

Keywords

Reforms • Bioterrorism • Policies

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Introduction

September 11, 2001 marked a critical turning point in world history garnering attention to the loose national security frameworks in place. One week after 9/11, through the mailing of letters laced with anthrax to congressional leaders and media outlets, a series of anthrax attacks (also known as Amerithrax) occurred. These events made obvious the necessity for widespread reform and a coordinated response system. Thus, followed suit were structural reforms for law enforcement, surveillance, and emergency preparedness, among other formed initiatives to combat looming threats. The importance of these protocols has become more evident over the years, as health departments and governmental organizations respond to emerging biological threats, for example, most recently, the COVID-19 virus.

In thinking about future emergency preparedness, key components that officials have thought about include: (1) projects to ensure continuing research to develop countermeasures and emergency supply distributions, (2) detection and surveillance of biological threats, (3) planning for emergency response actions, and (4) workforce capacity.

The objective of this literature review is to analyze the impact of the 2001 anthrax attacks in the United States that led to the evolution of new protocols across multiple public health, medical, and government agencies and how these new programs and policies have been utilized to improve emergency response capacity to deal with public health emergencies. This literature review will address the question: How did the 2001 anthrax attacks following 9/11 influence organizations to implement updated policies aimed at improving preparedness in bioterrorism to prevent widespread public health crises and delays in emergency response in the future? The paper will (1) discuss and compare previous systemic organization with data on the effectiveness and success of programs and policies established after the 2001 anthrax attack, (2) examine the role of the political, scientific, and public health communities in shaping these policies, and (3) analyze for gaps in performance to make recommendations for future improvement.

Methods and Search Strategy

The basis of this literature review stems from academic, government, and peer-reviewed sources including papers, databases, and reports dated from any time since the 2001 anthrax attack: September 18th, 2001. Some frequent search engines include but are not limited to the National Institute of Health, Google Scholar, Yale library Quicksearch, the Center for Disease Control and Prevention, JAMA Network, and the American Medical Association. Key terms utilized in this search include "2001 anthrax attack," "implications of policies to combat bioterrorism," "countermeasures against biological threats," and key names of new programs and policies established from already found reports or personal training experience as a first responder in the list below:

Public Health Security and Bioterrorism Preparedness and Response Act in 2002, Strategic National Stockpile (SNS), Laboratory Response Network (LRN), National Response Framework in 2008 (NRF), Biowatch, Public Health Emergency Preparedness program, National Incident Management System (NIMS), Project Bioshield in 2004, Hospital Preparedness Program (HPP), Medical Reserve Corps (MRC), National Biosurveillance Integration System (NBIS), Pandemic and All-Hazards Preparedness Act (PAHPA), Chempack Program, Public Health Information Network (PHIN), Emergency Use Authorization (EUA), Health Alert Network by CDC (HAN), Incident Command Systems (ICS), Public Readiness and Emergency Preparedness Act (PREP),

National Interagency Biodefense Campus (NIBC), Public Health Workforce Resilience and Training Programs, Public Health Emergency Preparedness Cooperative Agreements (PHEP)

For the purpose of this literature review, only some of the programs and policies above will be analyzed for historical circumstance, effectiveness, and space for future improvement.

Analysis

Historical Perspectives

As the anthrax attack was carried out leveraging the functions of the national postal system, cross contamination and inhalation of the bacteria guaranteed fatalities. According to the NIH Record on the 2001 anthrax attack, "Inhalational anthrax is the deadliest form . . . without aggressive treatment" (Bock, 2022). Additionally, the cost of decontamination and the lack of expertise by doctors further strained the process to mitigate effects of the attacks. Noted in these papers is an encounter with anthrax attack threats in 1998. Yet, despite an evaluation by the Center of Disease Control which resulted in a report with "recommendations for response to bioterrorism threats" (Bales, 2022), no significant steps were taken to ensure proper response for the attack in 2001. And when investigating even further back into history, from 1995 to 1996, the yersinia pestis bacterium responsible for causing the plague was found to be "illegally obtained . . . by mail order" by a former Aryan Nations member. This resulted in the passage of Section 511 of the Antiterrorism and Effective Death Penalty Act of 1996 (Federal Select Agent Program, 2020). Historical precedent shows that bioterrorism threats are not a new phenomenon, but they were likely disregarded due to the lack of severe consequences. While the passage of Section 511 was a step forward, the vulnerabilities in preparedness remained evident. Consequently, the 2001 anthrax attacks resulted in five deaths, seventeen infected, and thousands of others with suspected exposures being placed on antibiotics.

The modernization of the health system came after "state laboratories were largely unable to test for anthrax or other bioterrorism agents," as well a healthcare sector that was "unable to effectively diagnose and treat patients infected with novel pathogens" (Gostin & Nuzzo, 2021). Hospitals that acted independently would soon organize with other agencies, developing health emergency plans for a wide variety of scenarios. As Hughes and Gerberding describes in their paper, "Anthrax Bioterrorism: Lessons Learned and Future Directions," the "importance of the 'golden triangle' of response between clinicians and clinical microbiologists, the health-care delivery system, and public health officials" became evident and steps to link other critical networks, such as, law enforcement and emergency response systems are finally happening (Hughes & Gerberding, 2002).

(1) To ensure continuing research to develop countermeasures and emergency supply distributions

By the conjoint effort of Tommy Thompson, former secretary of the HHS and Tom Ridge, former secretary of Homeland Security, project BioShield Act of 2003 was proposed. President Bush pushed for the rapid passage of the act in his State of the Union Speech arguing that the investment into biotechnology research and the production of vaccines and treatments is not only for national security but will also yield insight into other diseases and generate secondary health benefits. On July 21st, 2004, Project BioShield was signed into law. The purpose of Project BioShield would

be to "speed the research, development, acquisition, and availability of medical countermeasures to improve the government's preparedness for and ability to counter chemical, biological, radiological, and nuclear threat agents" (Russell, 2007), creating a process to streamline and procure necessary medical countermeasures, bypassing FDA approval in emergency circumstances (House Hearing, 108 Congress, U.S. Government Printing Office). The Emergency Use Authorization (EUA) has been used in conjunction with the support of the Public Readiness and Emergency Preparedness Act (PREP) which provides immunity to manufacturers of medical advances in times of emergencies.

These authorizations have allowed for doxycycline to be used for post anthrax exposure in 2016, in 2009 for the H1N1 (swine flu) pandemic for the use of the drugs: Tamiflu, Relenza, and Rapivab, diagnostic test for the MERS Coronavirus, Ebola diagnostic tests, and more recently for COVID vaccines and tests (Zuckerman, 2021). However, despite important outcomes as the product of the passage of these acts, Congress in their legislation failed to address potential pharmaceutical misuse of EUAs. Zuckerman, in her paper, criticizes the abuse of EUA, recognizing urgency but expresses disapproval of the renewal of products for years without data to suffice FDA approval (Zuckerman, 2021). The fine prints of EUAs are not straight forward despite the FDA's publication of a guidance document titled "Emergency Use Authorization of Medical Products and Related Authorities," for the industry and stakeholders. In studying the COVID-19 pandemic and the use of EUAs, Zuckerman makes clear that inconsistent standards and overreliance on products without thorough evaluation could be harmful to public safety instead (Zuckerman, 2021). This may serve as an incentive to pharmaceutical companies to prioritize profit over critical results, thereby creating another public health crisis. While the paper does not address how PREP and EUA regulations can be modified or how it will affect public perception, policy experts need to address these inconsistencies as public health interventions will only work effectively with trust from the public.

(2) Detection and surveillance of biological threats

To detect biological threats after 2001, programs like BioWatch, the Laboratory Response Network (LRN), the National BioSurveillance Integration System (NBIS), the Public Health Information Network (PHIN), the Health Alert Network (HAN), among others were created. Kham and Bachman examined the many methods used to detect bioterrorism in multiple surveillance programs, highlighting the significant overlook on coordination between agencies (Kman & Bachmann, 2012). Syndromic surveillance is one of the most widely used systems where data is collected from hotline calls, hospital admissions, medication purchases, and other epidemiological methods. The concurrent step is laboratory surveillance which is designated "the cornerstone of diagnosis." In conjunction, respiratory illnesses and outbreaks can be tracked, monitored, and communicated with other networks. The response of the LRN, however, is stifled by differences in state and local laws on mandated reporting which poses a barrier to collaboration and the associated high cost. Mutual understanding between state authorities would help bridge the gap in protocols and cut down on gaps in response times.

(3) Planning for emergency response actions

After the 2001 events, the coordination of emergency response was prioritized. The Public Health Security and Bioterrorism Preparedness and Response Act was passed in 2002 establishing the Strategic National Stockpile (SNS). The SNS has been utilized during the H1N1 outbreak of

2009, amidst Hurricane Katrina, during the 2022 monkeypox outbreak, and COVID-19 (Hollett & Jarrett, 2024) to distribute emergency supplies. This means upkeeping the vast amounts of supplies for when emergencies do occur, however, the SNS has faced difficulties with supply demand, expiration dates, wastefulness, and FDA approvals.

Hollett and Jarrett in their paper, "How Should Resources from National Stockpiles Be Managed," examine the flaws of the SNS in stockpiling. These include the necessity to fight for a continuous stream of funding and concerns in stockpiling. They argue that the SNS should always exist but will always face challenges unless concerns about access and equity, disputes over intellectual property, sources and stockpiling, and the complexity of manufacturing are resolved. To address these, they propose new manufacturing techniques like 3D printing personal protective equipment under the Defense Production Act which "allows the presidential administration to utilize private manufacturing capabilities" (Hollett & Jarrett, 2024). In doing so, they failed to consider the implications of relying on private companies and how distribution could still be unequal. Further research should be conducted by both local and state governments into strategies to address these issues are critical.

Another component of emergency response actions revolves around protocols established for first responders and volunteers. These include but are not limited to mandatory trainings provided by the Department of Homeland Security, such as, the National Response Framework (NRF) which is directly related to systems like the National Incident Management System (NIMS) and Incident Command System (ICS). Communication plays a crucial role in these plans, thus, Public Health Communication Plans, the Health Alert Network (HAN) by the CDC, and the Public Health Information Network (PHIN) were created. However, communication systems built after 9/11 have been deteriorating (Gostin, 2021). Data from the COVID-19 pandemic shows the consequences of the "failure to maintain public health readiness" efforts (Gostin, 2021). Both federal funding and workforce continues to deplete, leaving an inadequate workforce to mitigate disaster. The authors do not investigate the reasoning behind the deterioration but highlight the importance of identifying a "comprehensive strategy to end the vicious circle of panic to neglect." Additionally, disparities in state healthcare mandates, such as vaccination policies and differences in public health understanding further limit the effectiveness of national interventions, perpetuating the circle.

(4) Workforce capacity

To address workforce shortages, programs, such as, the Medical Reserve Corps (MRC), Public Health Workforce Resilience Programs, Hospital Preparedness Program (HPP), and the Public Health Workforce Resilience and Training Programs were created. The goals were to build a force of resilience in workers, address accumulated stress, and support mental health wellness. By ignoring these signs and symptoms, it may hinder health care professionals from fulfilling their mission in helping the larger population (Preston, 2022). With increasing pressure, more and more workers are leaving the workforce. Preston (2022) highlighted contributors of stress and inform healthcare workers on strategies to reduce stress. Wellness support is crucial to maintain a workforce but does not help with the shortage in workforce in moments of emergencies, therefore programs to attract new health care and public health professionals are necessary. These can include loan forgiveness programs, scholarships and incentives, and an increase in training and hiring to support the existing workforce.

Conclusion

For a health system to function efficiently and effectively, there must be a sufficient workforce, well-designed infrastructure and service delivery, critical analysis from gathered data, enough medical technologies, enough funding, and good leadership. Prior to 2001, coordination between health departments, laboratories, government organizations, hospitals, and other key figures in the United States was practically non-existent. After 2001, multiple efforts have been created in attempt to address future biological threats but preparations for possible risks and continuing evaluation should be considered.

Recommendations for the future:

1. Early warnings of potential biological threats were often ignored and long-term prevention planning is often neglected. To prevent this, more funding into training a workforce capable of performing critical analysis and making informed decisions is crucial.
2. There should be further investigation into the "bare minimum" requirements of the EUAs and how many drugs and/or procedures are ultimately FDA approved (and reasons for non-approval) to create new policies to prevent abuse of profit by the pharmaceutical industry. Additionally, ensuring timely follow up on EUAs and new data is critical in ensuring drug effectiveness and public safety.
3. The COVID-19 pandemic exposed weaknesses in processes and programs after 2001. A thorough investigation into all of the policies and programs must be conducted to ensure future responses are effective. This means assessing their impacts and outcomes in historical context. These evaluations should be held every few years and results of these evaluations should indicate future implications of current policies. Legislators should use these evaluations to ensure policies remain effective and relevant.
4. To address the shortage in workforce, training of new talents and increasing the workforce should be a governmental priority. Increasing the workforce will not only aid in crises, but will also help relieve stress of current workers and make the workforce more efficient.
5. In conjunction, increasing funding to all of the support networks is important. Current constraints in funding limit the capacity for adequate infrastructure and a steady supply of medical technologies. Investments and/ or relocation of funding will also promote reflections to better address emerging threats.

This literature review only reflects on some of many programs and policies created after the 2001 9/11 and anthrax attacks to bridge emergency responses and enable better preparation for the future. Interventions without evaluation may be ineffective or a waste of resources. More comprehensive individualized case studies and field testing on programs listed in the methods section (and beyond) is necessary to inform policy and integrate effective cooperation among organizations.

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