

ORIGINAL RESEARCH

The Effect of Anthrax Bioterrorism on Emergency Department Presentation

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ABSTRACT

Study Objective: From September through December 2001, 22 Americans were diagnosed with anthrax, prompting widespread national media attention and public concern over bioterrorism. The purpose of this study was to determine the effect of the threat of anthrax bioterrorism on patient presentation to a West Coast emergency department (ED). **Methods:**

Guidelines for CaJEM Paper Submissions

OVERALL DESIGN

- Font should be in Times New Roman, 12 point.
- Submissions should be single-spaced and left-aligned with a space between paragraphs and no indentation.

MARGINS AND ALIGNMENT

- Page margins should be one inch on all sides.
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- The title page should have the following five elements, with one space below each element:
- The title of the submission in 18 point boldface, center aligned.
- The authors in 12 point boldface, the name separated from the titles by a comma.
- The institution of origin in 11 point italics.
- The word "Correspondence" in 12 point boldface, with address information in 12 point regular.
- Any history of prior data presentation, financial interests, or other pertinent information regarding the submission in 11 point italics.

ABSTRACT

- If an abstract is included, it should be in 11 point boldface, justified text.

HEADINGS

- Headings should generally be entitled: ABSTRACT, INTRODUCTION, METHODS, RESULTS, DISCUSSION, REFERENCES. A CONCLUSIONS section could be included as well, at the author's discretion. Furthermore, an OBJECTIVES section may be substituted for the INTRODUCTION section if the author wishes.
- Limitations to the study should be addressed in the DISCUSSION section.
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- Headings should be in 12 point Times New Roman boldface caps.
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INDENTED TEXT

- Indented text should be employed instead of quotation marks for quotations more than three lines long, approximately.
- It should be in 11 point, justified, with a space above and below the quotation, and the margins of the quotation should be ½ inch inset from both the left and right page margins (so, 1½ inches from the edges of the page).
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FOOTNOTES

- Please place footnotes at the end of sentences only.
- They should be placed after the period, like this.¹
- Use the superscript function to place a footnote.
- There should be no spaces between multiple footnotes attached to the same sentence, and commas and hyphens should separate them, like this.^{2,3,5,7}

TEXT CONVENTIONS

- Place one space after punctuation.
- The first time an abbreviation is presented, please spell it out and put the abbreviation in parentheses.
- If an abbreviation is presented in the abstract, please spell it out once again the first time it is presented in the body of the submission.
- When using the terms i.e. or e.g., they should be punctuated with periods, and a comma should be placed after them. They should not be italicized, and nor should etc., et al., or other commonly used Latin terms.
- Decimals between zero and one should be presented as 0.23, 0.05, etc., not .23 or .05.
- The signs =, >, and < should not have spaces around them: p<0.05, not p < 0.05.
- A comma should be placed between a month and a year, as in September, 1975.

TABLES AND FIGURES

- Tables and figures should be placed at the end of the paper.
- Tables should have row and column headings in boldface.
- Information should generally be centered on the first line of the table cell.
- Please capitalize the initial letter of important words in the row and column headings.
- Captions should be in boldface.
- Title captions should follow this basic format:

Figure 2. Effect of amiodarone on blood pressure.

REFERENCES

- References should be listed in 11 point, justified.
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- The titles of referenced published papers should be in lowercase except for the first letter of the first word.
- Journal names or their abbreviations should be in italics, without a period at the end.
- Reference format should be based on the following structure:
 4. Keyes LE, Snoey ER, Christy D, Simon BR, Frazee BF. Ultrasound guided brachial and basilic vein cannulation in emergency department patients with difficult intravenous access. *Annals of Emergency Medicine* 1999;34:711-4.

Adhering to these guidelines will greatly facilitate the review process, and is much appreciated. Thank you very much.

This survey was conducted at an urban county ED in Oakland, CA between December 15, 2001 and February 15, 2002. During random 8-hour blocks, all adult patients presenting for flu or upper respiratory infection (URI) symptoms were surveyed using a structured survey instrument that included standard visual numerical and Likert scales. Results: Eighty-nine patients were interviewed. Eleven patients (12%) reported potential exposure risk factors. Eighty percent of patients watched television, read the newspaper, or listened to the radio daily, and 83% of patients had heard about anthrax bioterrorism. Fifty-five percent received a chest x-ray, 10% received either throat or blood cultures, and 28% received antibiotics. Twenty-one percent of patients surveyed were admitted to the hospital. Most patients were minimally concerned that they may have contracted anthrax (mean=3.3±3.3 where 0=no concern and 10=extremely concerned). Patient concern about anthrax had little influence on their decision to visit the ED (mean=2.8±3.0 where 0=no influence and 10=greatly influenced). Had they experienced their same flu or URI symptoms one year prior to the anthrax outbreak, 91% of patients stated they would have sought medical attention. Conclusions: After considerable exposure to media reports about anthrax, most patients in this urban West Coast ED population were not concerned about anthrax infection. Fear of anthrax had little effect on decisions to come to the ED, and most would have sought medical help prior to the anthrax outbreak.

KEY WORDS

Bioterrorism, anthrax, emergency department presentation

INTRODUCTION

The threat of bioterrorism in the United States became a reality in the fall of 2001. The United States Postal Service was the vehicle used to disseminate letters containing weapons-grade *Bacillus anthracis* spores, and unfortunately, anyone handling those letters, including postal workers and office personnel, was placed at risk. Exposure to inhalational anthrax first occurred in Florida with subsequent cases emerging

in the District of Columbia, New Jersey, New York City, Maryland, Pennsylvania, and Virginia.¹ In the end, 22 people were infected: 11 with inhalational anthrax, 7 with cutaneous anthrax and 4 with suspected cutaneous anthrax. Five of the patients afflicted with inhalational anthrax died.¹

Although ineffective at causing mass casualties, this simple method of distribution in combination with the ease of contamination created a general paranoia throughout the United States causing considerable expense and significant disruption of our daily lives.² Media broadly reported the signs and symptoms of anthrax, which at the outset are similar to symptoms of influenza or other respiratory diseases.³ Supplies of ciprofloxacin, reportedly the most effective treatment for anthrax, dwindled as many Americans received prophylaxis for possible anthrax exposure and public health institutions stockpiled emergency supplies. In all, it is estimated that 10,000 people received treatment for possible anthrax exposure.¹

Although this anthrax attack and subsequent widespread media exposure undoubtedly spurred an increase in public awareness and fear of bioterrorism, it is unclear how much it truly impacted patient presentations for evaluation of possible anthrax disease, especially in areas away from the East Coast. The purpose of this study was to determine the effect of this wave of anthrax bioterrorism and media reports on patient presentation to a West Coast emergency department (ED).

METHODS

Subject selection and survey

Our hospital's institutional review board approved this study. The survey was conducted at the Alameda County Medical Center Emergency Department in Oakland, CA between December 15, 2001 and February 15, 2002. This urban ED has approximately 63,000 patient visits annually with a majority of patients being African-American. All patients aged 18 and over with influenza-like or upper respiratory infection complaints (cough, fever, rhinorrhea, myalgias) were surveyed using a structured survey

instrument. These complaints and symptoms were chosen because of widespread media reports that these were symptoms possibly relating to early anthrax disease. Physicians and research coordinators administered the survey to all eligible patients during specified eight-hour time increments. Patients with altered mental status and those unable to participate with an interview were excluded. The survey instrument used standard 1-10 numerical scales and yes/no questions. In addition to demographic information, patients were asked questions about the frequency of which they were exposed to different types of media and whether they had heard about anthrax or other types of bioterrorism, such as smallpox, plague, tularemia, botulism, viral hemorrhagic fevers, and brucellosis.

Data Analysis

Data analysis consisted primarily of descriptive statistics (frequencies, percentages, and raw data). Independence of factors was assessed via multiple logistic regression analysis, using Stata (version 6.0, Stata Corp., College Station, TX). Categorical variables were analyzed via chi square tests.

RESULTS

Table 1 lists demographic information about the 89 subjects enrolled in the study. Approximately 21% of the subjects were admitted to the hospital for further management, none with the diagnosis of “anthrax” or “rule out anthrax.” Table 2 lists the frequency of media exposure reported by the participants. Over two-thirds of the subjects reported daily media exposure to at least one form of media, with television viewing being the most frequently reported daily exposure. Print media was the least likely to be reported by our population, with one-quarter of the subjects denying any exposure to newspapers or news magazines. The level of media exposure was significantly associated with knowledge of recent bioterrorism. Eighty-three percent of the participants reported that they had heard the news of recent potential bioterrorism. Using daily media exposure as the relative variable, we observed a 6-fold decrease in reporting knowledge of bioterrorism compared with weekly exposure. The sole participant that denied all media exposure also

Variable	n (%)
Age	
15 - 24	10 (11.2)
25 - 34	22 (24.7)
35 - 44	18 (20.2)
45 - 54	28 (31.5)
55 - 64	4 (4.5)
65 +	7 (7.9)
Gender	
Male	44 (49.4)
Female	45 (50.6)
Ethnicity	
African-American	61 (68.5)
Hispanic	9 (10.1)
Asian American	3 (3.4)
Caucasian	11 (12.4)
Other	5 (5.6)
Education (n= 88)	
< 12 years	21 (23.9)
12 years	30 (34.1)
13 - 16 years	35 (39.7)
>16 years	2 (2.3)
Primary Language	
English	76 (85.4)
Spanish	6 (6.7)
Chinese	6 (6.7)
Other	1 (1.1)
Primary Physician (n= 86)	
Yes	34 (39.5)
No	52 (60.5)
Insurance Status	
None	52 (58.4)
State	31 (34.8)
Private	6 (6.7)
Disposition	
Home	70 (78.7)
Admitted	19 (21.3)

Table 1. Self-reported demographic information; n=89 unless otherwise specified.

Type of Media	n (%)
Print	
Daily	34 (38.2)
Weekly	33 (37.0)
None	22 (24.7)
Television	
Daily	56 (62.9)
Weekly	24 (27.0)
None	9 (10.1)
Radio	
Daily	46 (51.7)
Weekly	28 (31.5)
None	15 (16.8)
Any Media Exposure	
Daily	71 (79.8)
Weekly	17 (19.1)
None	1 (1.1)

Table 2. Frequency of Media Exposure. n=89.

denied knowledge of bioterrorism. Overall, when comparing those with daily media exposure to those without, we observed a 7-fold increase in reporting knowledge of bioterrorism. The odds ratio was 7.14 (95% CI, 2.17–24.6).

Figures 1 and 2 illustrate the level of concern that the subjects reported regarding the likelihood of having contracted a bioterrorism-related illness and how fear of bioterrorism influenced their decision to visit the ED, respectively. The majority of subjects reported that they had little concern (< 5 on the numerical scale) of having contracted a bioterrorism-related illness. Thirty percent of the subjects reported moderate to extreme (5-10) concern that they had contracted such an illness and were deemed a “higher concerned group” for analysis of associations. Similarly, the majority of subjects reported that concerns of bioterrorism had little influence on their decision to seek medical care for their current symptoms. However, 20% of the subjects did report a moderate to extreme concern (5-10) that influenced their visit; this group was deemed a “high influence of concern over bioterrorism group” for further analysis.

The utilization of hospital resources such as chest x-rays, blood cultures, throat cultures, and antibiotics are listed in table 3. Most subjects received chest radiographs, and a few received blood or throat cultures. Twenty-seven percent of the subjects received antibiotics, either upon hospital admission or discharge from the ED.

The univariate associations between knowledge of bioterrorism and demographic variables are listed in table 4. Only young age was significantly associated with this knowledge; subjects in older age groups were less likely to report knowledge of bioterrorism. This

association was not confounded by media exposure, as the odds ratio remained the same when controlling for this exposure.

Univariate associations for high concern for contracting a bioterrorism-related illness were also investigated using demographic variables. Only gender was observed to be associated with this response — men were more likely to report high concern compared

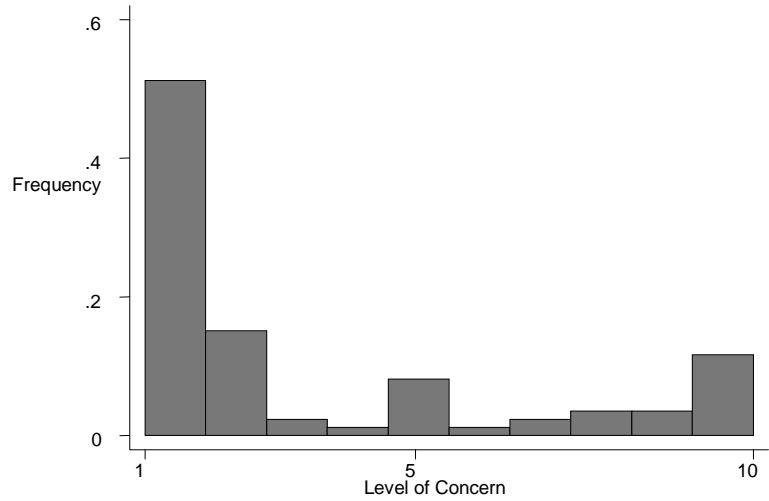


Figure 1. Distribution of responses regarding level of concern of having contracted a bioterrorism-related illness. (1=not at all concerned, 10=extremely concerned)

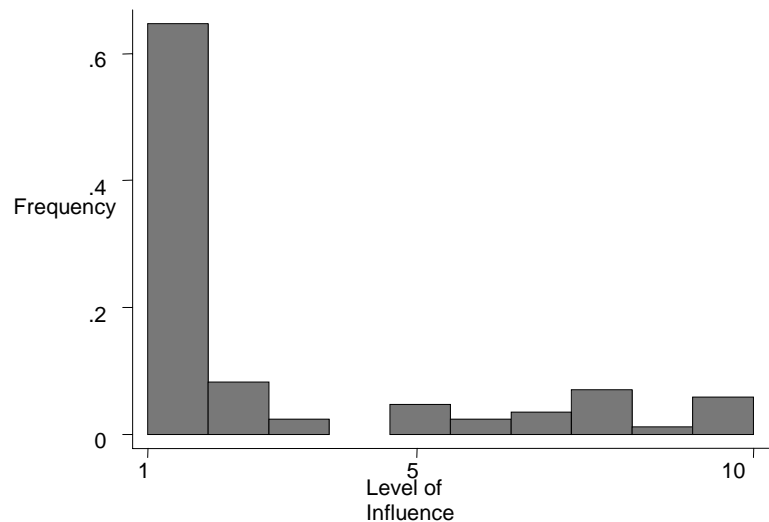


Figure 2. Distribution of responses regarding whether reports of bioterrorism influenced their decision to visit the ED. (1=did not influence at all, 10=greatly influenced)

with women. The odds ratio was 3.28 (95% CI, 1.23 – 8.76).

Univariate association for the “high influence of concern over bioterrorism” group was also investigated. Knowledge of bioterrorism was associated with a lower likelihood of being influenced to visit the ED (OR=0.21; 95% CI, 0.06– 0.79). However, reporting a high concern for contracting a bioterrorism-related illness was associated with a 12-fold increase in reporting that one was highly influenced to visit the ED (OR=12.05; 95% CI, 3.82–37.97).

The utilization of resources was not associated with either the level of concern with bioterrorism-related illness or with influence to visit the ED. Similarly, we did not observe an association between level of concern and whether the participant would have visited the ED for the same complaint a year prior to the study. Lastly, disposition was unaffected by patients’ concern with bioterrorism-related illness.

DISCUSSION

When the wave of bioterrorism anthrax cases hit the United States, the American public encountered a new dreadful crisis. Reports of suspected and confirmed anthrax cases saturated television, radio and print media. Some predicted that healthcare facilities—especially EDs— would be flooded with patients

panicking over concerns that they may have contracted anthrax or other bioterrorism-related diseases.⁴ In this first examination of the public response to bioterrorism, we found that fear of bioterrorism-related illness had at most a moderate impact on patient presentation to a West Coast urban county ED. Thirty percent of our participants reported moderate to extreme concern regarding the chance they contracted a bioterrorism-related illness, and 20% of subjects reported that their concern of bioterrorism at least moderately influenced their decision to visit the ED. We noted that high level of exposure to media and young age were independently associated with knowledge of bioterrorism and that male gender was the only predictor of moderate to extreme concern over having possibly contracted anthrax.

Although we determined fear of anthrax to be of modest impact on ED presentation, this level of concern almost certainly reflected an increase over the virtually non-existent lay-public concerns prior to the first anthrax cases. Few, if any, patients likely presented because of anthrax-related concerns prior to the first nationally publicized case, and the 20% of subjects moderately or greatly influenced to visit the ED in our study could translate into 54 million ED visits in the event of a nationwide anthrax bioterrorism scare.

The lack of association between knowledge of anthrax bioterrorism and influence on decisions to present to the ED is noteworthy. It is possible that patients knowledgeable about anthrax knew they were truly at low risk for the disease. It is also possible that our study included too few patients who had not heard of anthrax to detect a significant difference.

Resource	n (%) utilizing this service
Chest X-Ray	46 (54.8)
Blood Cultures	13 (15.5)
Throat Cultures	4 (4.8)
Antibiotics	23 (27.4)

Table 3. Utilization of resources (n = 84)

Variable	Odds Ratio	95% Confidence Interval
Age (10 year blocks)	0.64	0.42 – 0.97
Gender (male)	2.17	0.68 – 6.98
Ethnicity (African American vs. others)	1.57	0.50 – 4.96
Higher education (some college and above)	1.56	0.49 – 5.02
Primary English speaking	0.88	0.17 – 4.45
Having a primary care doctor	1.05	0.31 – 3.54
Having any healthcare insurance	0.56	0.18 – 1.72

Table 4. Association between knowledge of bioterrorism and demographic variables.

Other notable limitations regarding our study include the constraints of time of study, as well as geographical location and patient population served by our ED. While our study included a block of time near the presumed height of public concern over anthrax (just after most of the cases were reported and confirmed), we may have missed the true peak of alarm and secondary presentation. It is very likely that the fears of having contracted anthrax were much more acute on the East Coast, where nearly all of the confirmed cases were encountered. We enrolled an insufficient number of patients who had traveled to the East Coast to make a determination as to whether this risk factor significantly impacted patient concern or presentation. Additionally, our findings may not reflect the anthrax concerns and effects on presentation of more affluent communities or EDs.

This is the first study to gauge the impact of bioterrorism on ED presentation. Galea et al reported that the terrorist attack on the World Trade Center had a significant impact on the development of post-traumatic stress disorder and depression.⁵ Although numerous editorial and news magazine articles have been written addressing related subjects, we were unable to find any other scientific study of the effect of bioterrorism on ED presentation (Medline searches using broad keywords: bioterrorism, anthrax). Overall, our study lays the groundwork for future examination of this important public health topic.

REFERENCES

1. Kienstra A, Endom E. Disaster medicine: bioterrorism and its impact on the emergency department. *Clinical Pediatric Emergency Medicine* 2002 Dec;3(4):231-238.
2. Zimble J. Bioterrorism. *Emergency Medicine Clinics of North America* 2002 May, Vol 20, Number 2.
3. Karwa M, et al. Bioterrorism and Critical Care. *Critical Care Clinics* 2003 April, Vol 19, Number 2.
4. Kaplan D. A new state of fear. *U.S. News and World Report* 2003 Oct:14-18.
5. Galea S, et al. Psychological sequelae of the September 11 terrorist attacks in New York City. *New England Journal of Medicine* 2002 Mar;346(13):982-986.