Smallpox-Related Knowledge and Beliefs Among Recent College Graduates

Timothy Bungum, DrPH; Charlene Day, PhD

Abstract. Recent world events have increased concern and preparations for possible bioterror events. Despite worldwide efforts to limit access to bio-weapons, smallpox is still considered a potential bioterror threat. Americans’ understanding of smallpox could prevent panic and enhance the willingness of citizens to receive vaccinations. Objective: The authors’ purpose in this study was to describe graduating college students’ levels of smallpox-related knowledge. Method summary: Participants at a graduation ceremony—mostly female, with a mean age of 28.4 ± 8.1 years—were handed a 35-item questionnaire that assessed smallpox knowledge and whether respondents would submit to vaccination under hypothetical circumstances. Results: The convenience sample was ignorant of numerous facts about smallpox and unaware of government efforts to prepare for an attack, answering an average of 3.8 out of 10 items correctly. Conclusion: These findings raise concern because, in a smallpox event, prompt responses to directives of public health officials will be necessary to maximize the effectiveness of response plans.

Key Words: bioterror, community health, health education, smallpox

Pursuant to the events of September 11, 2001, bioterrorism-related concerns have increased in the United States. This unease is evidenced by the US government spending millions of dollars in efforts to prevent and prepare for bioterror attacks.1 An often mentioned bioterror weapon is smallpox, which is described by some as the worst-case scenario of bioterrorism.2 The seriousness with which public health officials perceive the threat of smallpox was demonstrated by Centers for Disease Control and Prevention officials who, on the above-mentioned date, evacuated the Atlanta building in which that virus is stored.3 Smallpox is a feared bioterror weapon because of its lethal characteristics: it has historically killed about 30% of those infected.4 Because vaccinations were discontinued in 1972—thus giving immunity to only a few US citizens—smallpox may be a tempting weapon for terrorists. Especially vulnerable to an attack would be the estimated 119 million Americans who have never been vaccinated for smallpox.5,6 Furthermore, it is uncertain whether those immunized prior to 1973 retain immunity, as it appears that protection wanes with the passage of time.6

Because of the apprehension related to smallpox, the dissemination of accurate information about the disease is important. The public should know the dangers of smallpox and how it is spread, along with the availability, effectiveness, and safety of vaccinations. Such information could enhance the effective delivery of vaccinations and attenuate panic.2 In a recent study, Blendon et al7 demonstrated that a majority of Americans are ignorant of many smallpox characteristics and hold false beliefs about the disease.

Although smallpox-related facts are available to the public,8 it is not known if bioterror information is reaching only selected segments of the population. Because college students are in an environment in which learning and the knowledge of current events are valued, we sought to quantify knowledge levels of smallpox-related facts among a subset of this population. We also sought to determine whether smallpox knowledge levels predicted voluntary submission to smallpox vaccinations.

METHODS
Participants

We recruited a convenience sample from a large southwestern university on the day of spring 2003 graduation. Approximately 27,000 students attend this public university, of which 6,000 were graduating students.9 We randomly approached potential participants as they aligned themselves in a procession staging area and asked them to complete a survey. We informed volunteers that the survey addressed a current public health issue, that the procedure would require about 5 minutes, and that upon completion, they would receive $1. The Institution Review Board at the
University of Nevada-Las Vegas approved this project, and participants signed an informed consent before completing the survey. Investigators, with a goal of surveying 200 graduates, funded the research.

**Instrumentation**

We employed a 35-item survey instrument based on the one used by Blendon et al. Participants responded to “yes” or “no” questions concerning the recent history of smallpox in the United States and the world, whether there is an effective medical treatment for smallpox, whether smallpox is contagious, and if those vaccinated within 4 days of exposure gain some protection from smallpox. Additional items assessed knowledge of whether physical contact with a person who has been recently vaccinated can produce serious illness, whether one can be infected with smallpox by the vaccine, whether there was, at the time, sufficient smallpox vaccine to vaccinate the entire US population, and whether one’s chances of contracting smallpox are increased by being physically proximal to a smallpox victim. We asked additional questions, presented on 4-point Likert-type scales, with anchor choices of (1) very likely and (4) very unlikely. The content of these items assessed whether certain side effects of the vaccine, including death, were likely to occur pursuant to a vaccination. Other “yes” or “no” items described scenarios under which respondents would agree to be vaccinated. We asked participants their age, race, gender, and college major(s).

**Statistical Analysis**

We calculated descriptive statistics on selected variables. We used logistic regression to determine whether smallpox-related knowledge predicted willingness to be vaccinated under 2 circumstances. We compiled all statistics using the Statistical Package for the Social Sciences.

**RESULTS**

The sample was predominantly female (57.8%), a majority were self-described as white (60.4%), and almost half were graduating from the College of Education (48.3%). Respondent mean age was 28.4 ± 8.1 years. Our goal was to sample 200 graduates, but because some respondents refused the one-dollar incentive, slightly more than 200 (n = 224) surveys were completed. Some potential participants refused offers to participate, but these were rare events. Although we did not collect data on refusals, we estimated that no more than 15 people refused participation.

The knowledge item that the largest majority of respondents correctly answered was that smallpox is contagious (90.5%). A large percentage of the sample also correctly responded that being within a few feet of a smallpox sufferer increases one’s risk of contracting the disease (70.0%). A considerable proportion of respondents (50%), however, incorrectly responded that those receiving the smallpox vaccine can be infected with the disease, and an additional 27.9% indicated that they did not know if smallpox could be transmitted via the vaccine. Most of our sample did not know (18.9%) that vaccination within 4 days of exposure can provide some protection against smallpox. Almost 80% of respondents erroneously thought that it is possible to be infected with smallpox by the vaccine. A small segment of respondents (22%) correctly answered that at the time of the survey there was sufficient vaccine to inoculate all US citizens.

Fewer than half of respondents knew that death is an infrequent side effect of the vaccine (40.3%) and that having physical contact with someone who has recently been vaccinated can cause a serious illness (39.6%). On a positive note, a majority (90.5%) of our sample knew that smallpox is contagious and that being within a few feet of someone with smallpox increases the likelihood of disease infection (69.8%). In deference to the opinions of 61.7% of our respondents, there is no specific treatment for smallpox. Vaccination within 4 days of exposure, however, is of great benefit, and receiving the vaccine within 7 days of the exposure may afford some protection. Many respondents were also ignorant of the history of smallpox—53.4% mistakenly believed that it had occurred in the United States in the past 5 years. The fact that a naturally occurring smallpox case has not appeared anywhere since the late 1970s was not known by most (91.7%) of our respondents. Overall, smallpox-related knowledge levels were low: the mean number of correct responses to 11 selected items was 3.8 ± 1.6.

Conditions under which respondents would be voluntarily vaccinated produced interesting but hopeful results. The scenario under which the highest proportion (82.6%) of our sample would receive the vaccination is if the disease were to occur in their community. A minority (8.5%) of participants indicated that they would be vaccinated under no circumstance.

We controlled for age, race, and number of correct responses, and the subsequent logistic regression procedure revealed that no variable was significant in predicting willingness to be vaccinated as a precaution for a bioterror attack or if smallpox occurred in one’s community.

**COMMENT**

The most interesting finding in this study is that many completing their college degrees are ignorant of, or hold numerous false beliefs about, smallpox. The beliefs that death is a frequent consequence of the vaccine and that the vaccine can cause smallpox are especially disconcerting. Either of these beliefs could cause citizens to refuse the vaccine. Death is, in fact, not a frequent sequel to the vaccination; experts estimate that about 1 death per 1 million vaccines will occur, which translates to slightly more than 200 deaths in the United States. Such death rates pale in comparison with the estimated 100,000 to 1 million deaths if a smallpox outbreak occurred in an unprepared America. It is also disconcerting that only 20.1% knew that one cannot be infected with smallpox by the vaccine. The vaccine does infect the person with a mild disease called vaccinia, but although vaccinia has similar characteristics to smallpox, it is a completely different disease.
Should a smallpox incident occur, the primary control measure advocated in the current administration plan is ring vaccination. This strategy was successfully used in the eradication effort of the 1960s and 1970s. The ring vaccination strategy does not require everyone to be inoculated, only those who have been in contact with victims. It is executed by employing vigilant surveillance and containment measures. A risk in using this strategy is that it will be criticized by employing vigilant surveillance and containment only those who have been in contact with victims. It is executed by employing vigilant surveillance and containment measures.

Some good news revealed in this study is that more than 80% of respondents would submit to vaccination voluntarily if smallpox were reported in their community, which is in congruence with current plans. We believe that the vaccination process could be more efficient and done with less panic if the populace was aware that there is vaccine for everyone, that the likelihood of the vaccine producing fatal consequences is small, and that the vaccine cannot give someone smallpox.

It is somewhat disappointing to learn that a large portion of college students did not know that smallpox had been eradicated more than 25 years ago, as this feat is considered to be among public health’s greatest contributions to humanity.

The results of this study should be viewed in context of its methodology. Our convenience sample was from a single large university located in the southwestern United States and may not be representative of students from other universities. We do not know whether these findings could be applicable to those living in other regions of the country. Our sample closely resembled the overall university make-up in terms of age and ethnic background; however, because the university holds 2 graduation ceremonies after each semester—and we collected data at only one—we cannot be sure that students from other colleges would respond similarly.

The findings from this study suggest that some college health officials may see the need to educate their constituents in regard to smallpox and how the government anticipates executing its postevent smallpox plan. Efforts to accomplish this could originate from the university’s student health service, health promotion, public health, public administration, or nursing departments as well as from the medical schools. Delivery method possibilities are numerous and could be accomplished via health fairs, seminars, guest speakers, symposiums, or classroom presentations.

**NOTE**

For comments and further information, address correspondence to Dr. Timothy Bungum, UNLV–Health Promotion, 4505 Maryland Parkway, Box 453050, Las Vegas NV 89154-3050 (e-mail: tim.bungum@ccmail.nevada.edu).

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