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Will First-Responders Show Up for Work During a Pandemic? Lessons From a Smallpox Vaccination Survey of Paramedics

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Background: The presence of H5N1 influenza in Southeast Asia has reawakened fears of a worldwide influenza pandemic of the sort that occurred in 1918. It is estimated that up to 1.9 million people in the United States could die if such an outbreak occurs. It is unlikely that a vaccine for a pandemic strain will be available quickly enough to protect first-responders. Similar concerns existed in 2002 when the United States attempted to vaccinate first-responders against smallpox, a potential biologic weapon.

Method: We conducted a survey of one group of first-responders, paramedics, to determine if fear of infection would compromise their ability to care for persons potentially infected with smallpox.

Results: Three hundred paramedics were given the survey, and 95 (32%) responded. More than 80% of paramedics polled would not remain on duty if there were no vaccine and no protective gear. Even if protective gear was available but the vaccine was unavailable, only 39% of respondents would remain on duty. Finally, although 91% of paramedics would remain on duty if they were fully protected, this number falls to 38% if the respondent believed that his or her immediate family was not protected. The results of this survey are relevant to current concerns about an influenza pandemic. Every effort must be made to protect first-responders from pandemic influenza and educate them about it.

The presence of H5N1 influenza in Southeast Asia has reawakened fears of a worldwide influenza pandemic of the sort that occurred in 1918. The "Spanish flu," as it was known, raged through the world, killing 40 to 50 million people in less than 1 year.[1] Currently (as of September 2006), the mortality rate in those infected with H5N1 avian influenza exceeds 50%, and if a pandemic occurs, it has been estimated that 1.9 million people in the United States could die.[2] At present, no vaccine is available for H5N1, and in the face of a pandemic, it could take 6 months or more to develop and disseminate a vaccine.[3] Given how quickly influenza would spread throughout the word, this would not be enough time to protect the population from infection.[2] First-responders, including physicians, nurses, police, firefighters, and EMS personnel, would be asked to care for infected patients without the protection of a vaccine. A similar situation existed in 2002 when there was some concern about a biological attack with smallpox.[4] At that time, we conducted a survey of one group of first-responders, paramedics, to determine if fear of infection would compromise their ability to care for persons potentially infected with smallpox. We believe that the results of this study are clearly relevant to the current fears about an influenza pandemic.

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Methods

The survey instrument was designed to provide facts about transmission, susceptibility and immunity, a clinical description of smallpox, and information about treatment and protective gear, followed by a questionnaire (Table 1). In August 2002, after obtaining Institutional Review Board approval, survey packets were distributed to approximately 300 paramedics employed by Huron Valley Ambulance, which serves a population of approximately 1 million in Washtenaw and surrounding counties. Packets, including stamped self-addressed envelopes for return of questionnaires, were delivered to employee mailboxes. Responses were confidential and voluntary.

If no vaccine was available and paramedics had no protective gear, 4 (4%) answered that they probably would remain on duty … no respondent definitely would remain on duty.

Results

Ninety-five questionnaires (32%) were completed and returned. The average age of respondents was 32 years. Fifty-six respondents (59%) were male, 57 (60%) were married, and 41 (43%) had children younger than 18 years of age. Participants were asked whether they would remain on duty to care for patients with smallpox in a variety of scenarios. Protective gear was defined as gloves, eye protection, and an N95 mask.

Table 1 depicts the results. If no vaccine was available and paramedics had no protective gear, 4 (4%) answered that they probably would remain on duty. In this scenario, no respondent definitely would remain on duty. If they were guaranteed that vaccine would be available within 4 days and protective gear were available, 42 paramedics (44%) definitely would remain on duty and 37 (39%) probably would remain on duty. If protective gear but no vaccine were available, 8 paramedics (8%) definitely would remain on duty and 29 (30%) probably would remain on duty. If protective gear were not available, even if they were guaranteed that vaccine would be available within 4 days, 7 (7%) definitely and 23 (24%) probably would remain on duty. If vaccine were available but there was no guarantee that it would arrive on time, 2 (2%) definitely and 12 (13%) probably would remain on duty. Eighty-six (91%) probably or definitely would remain on duty if they were prevaccinated and knew they were protected from infection. That number decreases to 56 (59%) if their families were not also protected with vaccine. Younger age, male gender, single status, and having no children younger than 18 years were associated with a greater likelihood of remaining on duty.

… 91% probably or definitely would remain on duty if they were prevaccinated and knew they were protected from infection. That number decreases to 59% if their families were not also protected with vaccine.

Discussion

The results of this survey indicate that in the event of an outbreak of a contagious disease like smallpox

Table 1. Smallpox questionnaire with responses of 95 paramedics

Question	Definitely not or probably not (%)	Maybe (%)	Probably or definitely (%)
Would you remain on duty to treat/care for patients with smallpox:			
If no vaccine was available and you had NO protective gear?	79 (83)	12 (13)	4 (4)
If no vaccine was available but you have protective gear?	27 (28)	30 (32)	37 (39)
If you could be guaranteed that vaccine would be available in time to protect you (within 4 days)? (You have NO protective equipment)	40 (42)	25 (26)	30 (32)
If you could be guaranteed that vaccine would be available in time to protect you (within 4 days)? (You have protective equipment)	7 (7)	9 (9)	79 (83)
If vaccine might be available but there was no guarantee that it would arrive on time?	54 (57)	27 (28)	14 (15)
If you had been vaccinated before and knew you were protected from infection?	2 (2)	7 (7)	86 (91)
If you were protected with vaccine but your family was not?	31 (33)	28 (29)	36 (38)

or pandemic influenza, a significant number of paramedics might be unwilling to remain on duty to care for patients without adequate protection against infection. More than 80% of paramedics polled would not remain on duty if there were no vaccine and no protective gear. Even if protective gear was available but the vaccine was unavailable, only 39% would remain on duty. Finally, although 91% of paramedics would remain on duty if they were fully protected, this number falls to 38% if the participant believed that his or her immediate family was not protected.

We believe that our results can be extrapolated to pandemic influenza given the similarities between the epidemiology of smallpox and a pandemic strain of influenza. Both viruses are capable of causing significant mortality; 1% to 30% for smallpox[5] and 3% to 56% for a new influenza strain.[2] Both viruses are contagious and can be transmitted to caretakers and family members efficiently through droplet spread.[2,5] Both viruses have been newsworthy in their ability to produce considerable morbidity and mortality, and the mention of either is enough to evoke fear and panic.[2,5]

Several recent studies have addressed public health worker and basic and paramedic emergency medical technician (EMT) perceptions about coming to work during a contagious outbreak.[6-12] Balicer et al.[6] surveyed 308 public health workers in Maryland about responding to an influenza pandemic. Fifty-four percent of respondents (163) indicated that they would likely respond to work during an emergency. Although respondents in this study were asked "how confident they were about being safe in their work roles"(33.8% were confident in personal safety), this study did not include statements about level of protection (vaccine vs. personal protective equipment [PPE] vs. all vs. none) as ours did. A large survey of 6428 health care workers (HCWs) from 47 health care facilities in New York City assessed the ability and willingness of responders to report to duty during catastrophic disaster.[7] Although more than 80% of HCWs would be willing and/or able to report to work for mass casualty or environmental disasters, only 57% to 68% would be willing and/or able to report to work during a severe acute respiratory syndrome (SARS) or smallpox outbreak. The most frequent reasons for not being willing to report to work included fear and concern for family (47%) and self (31%).[7] In a 2003 survey of 1919 EMTs, only 65% of respondents were willing to report to work during a smallpox outbreak.[8] Although there were no specific questions regarding level of protection against smallpox in this survey, basic and paramedic EMTs who had undergone terrorism-related training were twice as likely to be willing to report to work.[8]

The SARS outbreak of 2003 also is instructive in assessing the willingness of first-responders to come to work during a contagious outbreak. A survey of more than 15,000 Singapore HCWs after the SARS outbreak revealed that 76% of respondents were afraid of falling ill with SARS.[9] However, 69.5% accepted the risk of getting SARS as part of their job. This acceptance of risk may have been easier given the belief that protective measures were effective (96% of respondents believed this).[9] During the SARS outbreak, there were several reports of HCWs in Hong Kong and Toronto either avoiding the physical examination of sick patients or simply refusing work assignments altogether.[10] In China, at the height of the SARS epidemic, one hospital had difficulty maintaining services because of absenteeism, some of which was attributed to fear of getting sick.[11] Toronto offered U.S. infectious diseases physicians $1400 per day to relieve exhausted Canadian physicians during the height of the second wave of SARS cases in Canada.[12]

Our study has several limitations, including a small sample size and a 32% response rate to the survey. This may have created a bias toward respondents who are more concerned about possible infection and, thus, less likely to remain on duty during an attack. However, this pilot study and the aforementioned studies raise serious concerns about the ability of an already stressed health care system to handle a large-scale outbreak such as pandemic influenza. First-responders including physicians, nurses, EMS personnel, and police have always accepted occupational risks as part of their jobs. However, as this survey and other surveys show,[6-12] this dedication should not be taken for granted, particularly during an influenza pandemic.

The mainstays of protection against influenza include vaccination, antiviral medications, and infection control (PPE). It is likely that vaccine will either be in short supply or not available during a pandemic.[2] Similarly, antivirals such as oseltamivir (Tamiflu) and zanamivir (Relenza) will be scarce and expensive. The Department of Health and Human Services has created priority lists and stockpiling strategies for both vaccine and antivirals[2] that are intended to favor first-responders during an outbreak. However, pandemic influenza will strike multiple localities at once, and there will be an intense scramble by state and local governments to acquire resources. Ill-prepared populations will certainly be left behind in the response.

The key to protecting first-responders is prepandemic planning. State and local governments must develop strategies for rapidly inoculating responders when vaccine becomes available. Plans for obtaining and disseminating antivirals must be made well ahead of an outbreak. The federal government has committed to stockpiling Tamiflu and Relenza for 25% of the U.S. population (~80 million courses), but much of that stockpile will be held at the federal level.[13] Some states and localities may decide to develop

more proximal stockpiles. Hospitals and local governments should consider stockpiling PPE equipment such as surgical masks, N95 masks, gloves, and gowns. These usually common items were suddenly in short supply during the SARS outbreak.[14] Finally, first-responders should be educated about how to protect themselves and their families during a pandemic. We believe that educated first-responders who understand that their protection is a priority are more likely to come to work.

References

1. Taubenberger JK, Reid AH, Fanning TG. Capturing a killer flu virus. Sci Am 2005;292:48-57.
2. Department of Health and Human Services. Pandemic flu plan [online, November 2005]. Available from: URL: http//:www2.cdc.gov/phlp/docs/PHLP_HHSPandemicInfluenzaPlan.pdf#search=%22hhs%20health%20outcomes%2C%20pandemic%20influenza%20mortality%201.9%20million%22.
3. Patriarca PA, Cox NJ. Influenza pandemic preparedness plan for the United States. J Infect Dis 1997;176(Suppl 1):S4-7.
4. Centers for Disease Control and Prevention Advisory Committee on Immunization Practices. Vaccination recommendations, CDC Public Health Emergency Preparedness and Response [online, October 2002]. Available from: URL: http://www.bt.cdc.gov/agent/smallpox/vaccination/acip-recs-oct2002.asp.
5. Henderson DA, Inglesby TV, Bartlett JG, Ascher MS, Eitzen E, Jahrling PB, et al. Smallpox as a biological weapon: medical and public health management. JAMA 1999;281:2127-37.
6. Balicer RD, Omer SB, Barnett DJ, Everly GS Jr. Local public health workers' perceptions toward responding to an influenza pandemic. BMC Public Health 2006;6:99.
7. Qureshi K, Gershon RR, Sherman MF, Straub T, Gebbie E, McCollum M, et al. Health care workers' ability and willingness to report to duty during catastrophic disasters. J Urban Health 2005;82:378-88, Epub 2005 Jul 6.
8. Dimaggio C, Markenson D, T Loo G, Redlener I. The willingness of U.S. Emergency Medical Technicians to respond to terrorist incidents. Biosecur Bioterror 2005;3:331—7.
9. Koh D, Lim MK, Chia SE, Ko SM, Qian F, Ng V, et al. Risk perception and impact of Severe Acute Respiratory Syndrome (SARS) on work and personal lives of healthcare workers in Singapore: what can we learn? Med Care 2005;43:676-82.
10. Stein BD, Tanielian TL, Eisenman DP, Keyser DJ, Burnam MA, Pincus HA. Emotional and behavioral consequences of bioterrorism: planning a public health response. Milbank Q 2004;82:413-55.
11. Wynia MK, Gostin LO. Ethical challenges in preparing for bioterrorism: barriers within the health care system. Am J Public Health 2004;94:1096-102.
12. Altman L. Behind the mask, the fear of SARS.*New York Times* June 24, 2003 [online]. Available from: URL: http://www.nytimes.com/2003/06/24/health/24DOCS.html?pagewanted=print&position.
13. Department of Health and Human Services. Pandemic planning update, March 13, 2006 [online]. Available from: URL: http://www.hhs.gov/panflu20060313.pdf#search=%2281%20million%20courses%20of%20Tamiflu%20%22.
14. Syed Q, Sopwith W, Regan M, Bellis MA. Behind the mask. Journey through an epidemic: some observations of contrasting public health responses to SARS. J Epidemiol Community Health 2003;57:855-6.