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## Initial Response of Healthcare Institutions to Emergence of H1N1 Influenza: Experiences, Obstacles, and Perceived Future Needs

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### Abstract

**Study Summary**—Of 323 healthcare epidemiology professionals surveyed during the H1N1 crisis, 30.7% reported shortages of antiviral medication and 39.0% reported stockpiling of antiviral medications. Vaccine development, healthcare worker education, revisions of pandemic plans, and mandatory influenza vaccination were identified as important future initiatives.

**Background**—The emergence of H1N1 influenza is cause for great concern. Although one of the most important components of the response to the H1N1 crisis is the work of healthcare epidemiology professionals, the beliefs and experiences of this community are unknown and the optimal approach to managing H1N1 in the future has not been delineated.

**Methods**—To assess attitudes and responses of healthcare epidemiology professionals to the H1N1 influenza crisis, we conducted a cross-sectional survey of members of the Society for Healthcare Epidemiology of America. We assessed beliefs regarding: 1) importance of H1N1; 2) institutional preparedness; 3) time spent on the H1N1 crisis; and 4) the institution's response to H1N1.

**Results**—Of 323 respondents, 195 (60.4%) reported their hospitals were well prepared for a pandemic. Furthermore, the majority reported that senior administrators provided adequate political

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support and resources (85.1% and 80.2%, respectively) to respond to H1N1. However, 163 (50.9%) respondents reported other important infection prevention activities were neglected during the H1N1 crisis. Shortages of antiviral medication were reported by 99 (30.7%) respondents. Furthermore, 126 (39.0%) reported that personal stockpiling of antiviral medications occurred at their institution and 166 (51.4%) reported institutional actions were initiated to prevent personal stockpiling. Also, 294 (91.0%) respondents believed H1N1 influenza would reappear later this year. Vaccine development, healthcare worker education, and revisions of pandemic influenza plans were identified as the most important future initiatives. Finally, 251 (77.7%) respondents felt healthcare workers should be mandated to receive influenza vaccine.

**Conclusions**—While generally well-prepared for the H1N1 crisis, substantial revisions of pandemic preparedness plans appear necessary. Future efforts to optimize the response to H1N1 should include curtailing personal stockpiling of antivirals and vaccine development with consideration of mandatory vaccination of healthcare workers.

### Keywords

H1N1; influenza; Survey; epidemiology

## INTRODUCTION

On 15 April 2009, novel swine-origin influenza A (H1N1) was identified from specimens of two epidemiologically unrelated patients [1]. Over the next two months, H1N1 spread to over 70 countries. On 11 June 2009, the World Health Organization (WHO) raised the worldwide pandemic alert level to Phase 6 indicating that a global pandemic is underway.

The ability to respond quickly in the face of an emerging infectious disease is critical for global patient safety efforts. Indeed, the capacity to collaborate across institutions and countries has proved critical in the success of recent pandemics such as severe acute respiratory syndrome (SARS) [2,3]. Furthermore, the ability to both rapidly mobilize investigations and then disseminate the findings is vital to identify both successes and failures in responding to emerging infectious diseases. Indeed, from a scientific standpoint, these experiences provide an invaluable opportunity to elucidate the epidemiology of the epidemic in “real time”, presenting the clear opportunity for such research to inform ongoing policy decisions [2].

Although one of the most important components of the response to the H1N1 influenza crisis is the work of the healthcare epidemiology community in responding to potentially affected individuals in healthcare institutions, the beliefs and experiences of this vital component of the response are currently unknown. Furthermore, the potential obstacles in responding to the emerging H1N1 pandemic have not been identified. Finally, the optimal approach to managing H1N1 in the future has not been delineated. We therefore surveyed healthcare epidemiology professionals who have been on the front-line during the H1N1 pandemic; their collective knowledge and experience can help guide strategic decision-making and future interventions aimed at controlling the H1N1 pandemic. Designing optimal interventions becomes increasingly important, as many experts fear H1N1 influenza will be more aggressive this coming fall and winter.

## METHODS

To assess the response of healthcare institutions to the emergence of H1N1 influenza, we conducted a survey of the membership of the Society for Healthcare Epidemiology of America (SHEA). The SHEA membership consists of individuals with an interest in healthcare epidemiology including healthcare epidemiologists, infection control professionals, infectious diseases physicians, infectious diseases trainees, pharmacists, and healthcare administrators.

Our target population for this survey was those individuals with leadership positions in healthcare epidemiology and/or pandemic preparedness at medical institutions. Although these individuals represented only a subset of all SHEA members, they are not specifically identifiable in the SHEA membership database. Therefore, an invitation to complete an internet-based survey was sent electronically to all SHEA members on 26 May 2009, with a repeat electronic survey reminder sent one week later.

This survey collected information regarding the respondent's demographics, education, and years in practice. We also assessed characteristics of the respondent's institution including the geographic location, number of beds, and academic affiliation. We focused on four specific domains when assessing the attitudes and response to H1N1 influenza: 1) importance of the H1N1 problem; 2) preparedness of the facility; 3) time spent on the H1N1 crisis; and 4) specific details of the institution's response to the H1N1 crisis.

We first analyzed the responses to each specific question in the survey (Table 1). Subsequently, we investigated whether the proportion of respondents responding affirmatively to specific questions dealing with preparedness differed based on whether or not the institution had a confirmed case of H1N1 at the time of survey completion. Categorical variables were compared using the chi square test [4]. All statistical calculations were performed using SAS version 01 (SAS Institute, Cary, NC).

This study was reviewed and approved by the Institutional Review Board of the University of Pennsylvania.

## RESULTS

There were 323 survey respondents, which represent 25.9% of the total SHEA membership. Respondents and non-respondents did not differ substantively when compared based on available data including age, sex, years since completing training, type of institution, and institution bed size. However, the proportion of individuals characterizing their primary role as related to healthcare epidemiology practice or administration was significantly higher among survey respondents compared to the full SHEA membership (78.9% vs. 66.4%, respectively;  $p < 0.001$ ). Furthermore, 48 non-respondents replied to a follow up email asking why they did not complete the survey. Of these 48 non-respondents, 27 (56.3%) did not work in healthcare facilities and/or did not believe the survey was relevant to their occupation. Twenty-one respondents reported not completing the survey because they had not had an H1N1 influenza case at their institution.

Of the total 323 respondents, 139 (43.0%) were women. The age distribution of respondents was as follows: 20–29 years: 1 (0.3%); 30–39 years: 49 (15.2%); 40–49 years: 88 (27.2%); 50–59 years: 131 (40.6%); 60–69 years: 46 (14.2%); >70 years: 8 (2.5%). The roles of respondents were: hospital epidemiologist: 160 (49.5%); infection control professional: 81 (25.1%); infectious diseases physician: 54 (16.7%); and healthcare administrator: 14 (4.3%), and “other” 14 (4.3%). Finally, respondents had varying levels of experience working in the field of healthcare epidemiology: <1 year: 4 (1.2%); 1–3 years: 27 (8.4%); 4–8 years: 71 (22.0%); 9–12 years: 44 (13.6%); 13–20 years: 77 (23.8%); 21–30 years: 57 (17.6%); and >30 years: 43 (13.3%).

The most common institutions at which respondents worked were academic medical centers: 135 (41.8%); community teaching hospital with academic affiliation: 73 (22.6%); community hospital with no academic affiliation: 63 (19.5%); and federal non-military hospital: 20 (6.2%). The bed size of institutions for respondents was: 0–49 beds: 6 (1.9%); 50–249 beds: 86 (26.6%); 250–499 beds: 100 (31.0%); >500 beds: 113 (35.0%); and not applicable: 18 (5.6%). Finally, 48 (14.9%) respondents reported 1 confirmed case of H1N1 influenza, 66 (20.4%) had 2–5

cases; and 73 (22.6%) had >5 cases. One hundred thirty-three (41.2%) respondents had not had a confirmed case of H1N1 influenza at their institution at the time of the survey.

Responses to survey questions are shown in Table 1. Of note, 169 (52.3%) respondents reported that prior to the current H1N1 crisis, their hospital was well prepared for a potentially pandemic situation. After reflecting on their institution's experience and response to the H1N1 crisis, 195 (60.4%) respondents reported that at the time of the survey, their hospitals were well prepared for a potential pandemic. Furthermore, the majority of respondents reported that senior administrators provided both adequate political support (85.1%) and adequate resources (80.2%). Despite the perceived adequate levels of support, 32.7% of respondents reported that during the busiest week of the H1N1 flu crisis, they spent greater than 60% of their time taking care of issues related to H1N1. On a related note, 50.9% of respondents reported that during the H1N1 flu crisis, other important infection prevention-related activities were neglected.

Ninety-nine (30.7%) respondents reported a shortage of antiviral medication during the H1N1 crisis. Furthermore, 126 (39.0%) respondents agreed that personal stockpiling of antiviral medications occurred during the H1N1 crisis at their own institution and 166 (51.4%) reported institutional actions were initiated to prevent personal stockpiling of antiviral medications.

Finally, 294 (91.0%) respondents believed H1N1 influenza would reappear in the fall and winter of this year. Vaccine development, healthcare worker education, and revisions of pandemic influenza plans were listed most commonly as the most important initiatives in the near future. With regard to vaccination, 251 (77.7%) respondents felt healthcare workers should be mandated to receive influenza vaccine or risk losing their jobs.

The proportion of subjects responding affirmatively to specific questions dealing with preparedness did not differ significantly based on whether or not the institution had a confirmed case of H1N1 at the time of survey completion.

## DISCUSSION

In this survey of the SHEA membership, we found that the majority of respondents felt their institutions were well prepared for the H1N1 crisis and were provided with adequate resources. However, the time commitment required to respond to this crisis was considerable, with attention to other critical infection prevention activities suffering as a result. Personal stockpiling of antiviral agents was common and many institutions implemented initiatives designed to curtail such practices. Finally, the vast majority of respondents believed H1N1 influenza would reappear within the next 6 months and that vaccine development, healthcare worker education, and revisions of pandemic influenza plans were the most important targets for resources in preparation.

Our results provide a unique and timely perspective on the response to the current H1N1 crisis. The healthcare epidemiology community plays a vital front line role in the response to emerging infectious diseases. Arguably, healthcare epidemiologists may be best prepared and optimally placed in institutions around the country to make determinations as to the adequacy and appropriateness of institutional preparedness and responses to emergency situations, particularly those that relate to emerging and re-emerging infectious diseases. Assessing the response and experience related to ongoing crises is critical to more effectively targeting future interventions and resources. It is encouraging that the majority of respondents believed they had adequate support and resources to deal with the H1N1 crisis. Indeed, the experience with SARS, and the threats of bioterrorism and avian influenza has led to considerable efforts to address pandemic preparedness at healthcare institutions throughout the country [2]. The H1N1 crisis represents the first real test of these initiatives, and suggests that these efforts have been largely successful in preparing hospitals to address emerging infectious diseases. However,

our results also suggest considerable opportunity for improvement remains. The time commitment reported by respondents, as well as the fact that other infection prevention activities were neglected during the H1N1 crisis, suggests more work is needed to further refine pandemic preparedness plans. Such plans should help ensure that other vital healthcare epidemiology activities are not ignored during an acute crisis, particularly an event such as H1N1 influenza that may last for several months. Indeed, revising such plans based on the H1N1 experience was one of the most common initiatives noted by respondents as urgent needs in the coming months. Future work should also assess beliefs and obstacles in responding to H1N1 among other healthcare professionals responding to the crisis (e.g., emergency department clinicians, nurses, etc).

Accessibility to antimicrobial agents in the event of a pandemic is a critical component of preparedness plans. In this light, it is concerning that one third of respondents reported shortages of antiviral medications. That personal stockpiling was reported by many respondents is perhaps not surprising, given past data showing this practice was also widespread during heightened fears of an avian influenza pandemic [5,6]. Efforts to discourage the prescribing of antivirals for personal stockpiling should be emphasized. Indeed, approximately half of the respondents' institutions initiated such efforts.

Finally, nearly 90% of respondents believe H1N1 will continue to be an important problem in the coming months. In considering strategies to better prepare for a resurgence of H1N1 in the near future, respondents highlighted vaccine development as a critical endeavor. Targeting development of an H1N1 influenza vaccine will however only have a significant public health impact if a substantial proportion of healthcare workers agree to be vaccinated. Given traditionally low rates of influenza vaccination for healthcare workers [7], the finding of a strong consensus among respondents that vaccination should be mandatory among healthcare workers was striking. It is also important to note that this survey primarily targeted the healthcare epidemiology community. Had other front line professionals (e.g., emergency department personnel, nurses, etc) completed the survey, it is quite possible that agreement with mandatory vaccination would have been substantially lower [8,9]. Indeed, the concept of mandatory influenza vaccination of healthcare providers has been a controversial area for some time [10,11]. The urgency imparted by the H1N1 crisis may lend additional support to initiatives designed to mandate vaccination of healthcare workers [12].

This study had several potential limitations. The vast majority of respondents were from the United States and Canada and over half of the respondents were located at institutions with academic affiliations. Therefore, generalizability of the findings to other regions and types of institutions is questionable. Although this represents the highest response rate recorded for a survey conducted through the SHEA network, the response rate was only approximately 25%. However, there were no substantive differences when comparing responders and non-responders. Furthermore, the survey was distributed to the full SHEA membership and many SHEA members do not hold primary positions relevant to the survey (and were therefore unlikely or unwilling to reply). As a result, our response is likely artificially low. Of those SHEA members who did hold positions within healthcare facilities, some did not respond because their institution had no noted H1N1 cases. Notably, we found no differences in responses comparing subjects whose institution did or did not have a confirmed H1N1 case.

In conclusion, this study provides important insights into the beliefs and experiences of epidemiologists at healthcare institutions regarding the recent H1N1 crisis. While generally well-prepared for the H1N1 crisis, substantial revisions of pandemic preparedness plans based on current experience appear necessary. Furthermore, future efforts to optimize the response to H1N1 should include curtailing personal stockpiling of antibiotics and vaccine development with consideration of mandatory vaccination of healthcare workers.

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Table 1

## H1N1 Flu Survey Responses

Survey Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
H1N1 flu is a very important problem.	122 (37.6%)	167 (51.5%)	27 (8.3%)	7 (2.2%)	0 (0%)
H1N1 flu is more important than the other infectious diseases/infection control-related problems that I deal with on a regular basis.	17 (5.2%)	59 (18.2%)	121 (37.4%)	114 (35.2%)	12 (3.7%)
Prior to H1N1 flu emergence, influenza was viewed as an important problem to hospital administrators at my institution.	29 (9.0%)	158 (49.1%)	62 (19.3%)	67 (20.8%)	6 (1.9%)
Senior-level hospital administrators at my institution (e.g., Chief Executive Officer, Chief Medical Officer, Chief Nursing Executive) believed that H1N1 flu was a more important problem than I thought it was.	21 (6.5%)	42 (13.0%)	97 (30.03%)	139 (43.03%)	24 (7.43%)
Prior to the current H1N1 crisis, my hospital was well prepared for a potentially pandemic situation such as H1N1 flu or avian flu.	21 (6.5%)	148 (45.6%)	78 (24.2%)	60 (18.6%)	16 (4.95%)
At this point in time, my hospital is well prepared for a potentially pandemic situation such as H1N1 flu or avian flu.	38 (11.8%)	157 (48.6%)	75 (23.2%)	44 (13.6%)	9 (2.79%)
During the H1N1 flu crisis, senior-level hospital administrators at my institution provided adequate political support.	116 (36.1%)	157 (48.9%)	32 (10.0%)	10 (3.1%)	6 (1.87%)
During the H1N1 flu crisis, senior-level hospital administrators at my institution provided adequate resources to respond to the crisis.	94 (29.1%)	165 (51.1%)	40 (12.4%)	21 (6.5%)	3 (0.93%)
During the H1N1 flu crisis, other important infection prevention-related activities were neglected.	58 (18.1%)	105 (32.8%)	60 (18.8%)	78 (24.4%)	19 (5.94%)
My attitude toward the CDC recommendations of reassigning pregnant healthcare workers who are in direct contact with patients with confirmed, probable or suspected H1N1 flu to lower risk activities is:	27 (8.5%)	114 (37.5%)	66 (20.7%)	64 (20.1%)	27 (8.46%)
All of the employees at my institution had been fit-tested for N-95 masks at the beginning of the H1N1 crisis.	36 (11.3%)	65 (20.3%)	17 (5.3%)	131 (40.9%)	71 (22.19%)
The recommendation for airborne precautions for suspected H1N1 cases was appropriate at the beginning of the H1N1 crisis at my institution.	62 (19.3%)	169 (52.7%)	33 (10.3%)	43 (13.4%)	14 (4.36%)
The recommendation for airborne precautions for suspected H1N1 cases was appropriate throughout the H1N1 crisis at my institution	24 (7.5%)	56 (17.5%)	51 (15.9%)	121 (37.7%)	69 (21.50%)
N-95 masks were readily available throughout the H1N1 crisis at my institution.	74 (23.1%)	135 (42.2%)	29 (9.1%)	54 (16.9%)	28 (8.75%)
Surgical masks have been readily available throughout the H1N1 crisis at my institution.	164 (51.1%)	135 (42.1%)	6 (1.9%)	12 (3.7%)	4 (1.25%)
Alcohol based hand hygiene products have been readily available throughout the H1N1 crisis at my institution.	206 (64.4%)	98 (30.6%)	8 (2.5%)	5 (1.6%)	3 (0.94%)
There was a shortage of antiviral medication during the H1N1 crisis at	39 (12.2%)	60 (18.7%)	53 (16.5%)	132 (41.1%)	37 (11.53%)

Survey Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
my institution.					
There was personal stockpiling of antiviral medications during the H1N1 crisis at my institution.	22 (6.9%)	104 (32.6%)	93 (29.2%)	77 (24.1%)	23 (7.21%)
My institution undertook efforts to prevent personal stockpiling of antiviral medications.	65 (20.3%)	101 (31.5%)	85 (26.5%)	57 (17.8%)	13 (4.05%)
The H1N1 flu is going to reappear this upcoming fall and winter.	101 (31.3%)	183 (56.7%)	35 (10.8%)	4 (1.2%)	0 (0%)
All healthcare workers should be mandated to receive the flu vaccine or risk losing their jobs.	122 (38.0%)	129 (40.2%)	31 (9.7%)	36 (11.2%)	3 (0.93%)