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A Survey of Emergency Department 2009 Pandemic Influenza A (H1N1) Surge Preparedness—Atlanta, Georgia, July–October 2009

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Abstract

During August through September 2009, a surge in emergency department (ED) visits for 2009 pandemic influenza A (pH1N1) illness occurred in Georgia, particularly among children. To understand surge preparedness and capacity, we obtained influenza-like illness (ILI) ED visit data from the Georgia State Electronic Notifiable Disease Surveillance System (SendSS) and conducted a retrospective, Internet-based survey among all 26 metro Atlanta ED managers with reference to the period 1 July–1 October 2009. SendSS detected a marked and progressive increase in mean monthly ILI visits from 1 July–1 October 2009, which more than tripled (from 399 to 2196) for the 2 participating EDs that cared for pediatric patients during this time. ED managers reported patient volume surges, resulting in space and supply limitations, especially at pediatric EDs. Most (92%) of the facilities had current pandemic influenza plans. Pandemic planning can help to ensure preparedness for natural and man-made disasters and for future influenza pandemics.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

The emergency department (ED) serves as the frontline for patients acutely entering the health care system. During natural disasters (i.e., hurricanes and earth-quakes)[1] and infectious diseases outbreaks (i.e., SARS)[2], patient demand for care in EDs and outpatient clinics increases. EDs frequently face significant surges in demand during pandemics because of their commitment to providing unplanned, emergent, and nonemergent health care services to all presenting patients. ED surge causes overcrowding in facilities without adequate physical space or personnel during peak demand [3]. In response to sustained increases in patient volume, facilities must rely on their surge capacity, defined as “a measurable representation of a healthcare system’s ability to manage a sudden or rapidly progressive influx of patients within the currently available resources at a given point in time”[4]. The central elements of ED surge capacity include space (eg, number of beds and physical size of the ED), staffing systems (eg, admitting process, clinical information systems, and ancillary services), and supplies [5]. ED overcrowding is the result in a mismatch between surge and surge capacity.[6]

After the first detected cases in the United States of infection with 2009 pandemic influenza A (H1N1) (pH1N1) in April 2009, [7,8] a dramatic increase in health care visits for influenza-like illness (ILI) was observed at a time when few influenza cases typically occur [9]. During August–October 2009, a surge in ED visits for ILI, especially among children, occurred throughout the southeastern United States coinciding with the start of the school year [10]. The impact of pH1N1 on ED patient care capacity has not been well characterized, and only limited reports describe the effects of seasonal influenza on ED patient load [11]. To understand surge preparedness and capacity in a metropolitan area in Georgia, we conducted a retrospective, Internet-based survey among all 26 metro Atlanta ED managers, with reference to the period from 1 July through 1 October 2009, the period with the most dramatic increase in ILI-associated ED visits in the southeastern United States [10].

METHODS

Metro-Atlanta ED ILI visit data was provided by Georgia’s State Electronic Notifiable Disease Surveillance System (SendSS), which collects data on all ED visits for 14 of the 26 hospital EDs in the Georgia Department of Community Health District 3 (metro-Atlanta), including Cobb, Clayton, DeKalb, Douglas, Fulton, Gwinnett, Newton, and Rockdale counties (2008 population 3,825,959 [US Census Bureau]). These 14 facilities represent an estimated 74.3% of the total visits in metro Atlanta in 2007 (unpublished data, Georgia Division of Public Health). ILI syndrome was defined as any text from the patient’s reported symptoms on presentation that included fever plus cough syndromes or fever plus sore throat syndromes or chief complaint of influenza, respiratory syncytial virus, or viral pneumonia. It excluded allergy and rash syndromes.

To assess perceived surge in patient visits, pandemic influenza preparedness, and lessons learned from 1 July through 1 October 2009, we surveyed managers from all 26 EDs, in Georgia Health District 3. Recruitment involved 1–3 calls to each ED manager explaining the study and requesting participation. Survey questions were deployed using a Web-based survey instrument (SurveyMonkey) during 2–9 October 2009. The instrument asked respondents to answer up to 34 questions across several screens about their ED, patient visits and overcrowding, and pandemic influenza planning (triage, alternative care sites, staffing, and supplies). After exiting the survey, respondent data were exported to an analytical dataset, transformed, and analyzed using SAS, version 9.2 (SAS Institute). Bivariate associations of dichotomous variables were statistically evaluated using Pearson's χ^2 test and Fisher's exact test to generate 2-sided *P* values. *P* values ≤.05 were considered to be statistically significant.

This survey was part of the emergency public health practice response to the pandemic and was reviewed by a human subjects coordinator at the Centers for Disease Control and Prevention (CDC) and deemed not to be research in accordance with the federal human subjects protection regulations at 45 Code of Federal Regulations 46.101c and 46.102d and CDC's Guidelines for Defining Public Health Research and Public Health Non-Research.

RESULTS

SendSS detected a progressive increase in mean ILI visits among participating metro-Atlanta EDs from August–October 2009, especially among those EDs caring for pediatric patients (Figure 1). Among the 2 participating EDs that cared for pediatric patients and of the 3 total in Health District 3, the combined mean monthly number of visits for ILI more than tripled (from 399 to 2196 during July–September 2009), nearly doubling the height of the 2008–2009 seasonal influenza season (1126 in February 2009). Compared with the adult and adult/pediatric EDs, the 2 EDs only caring for pediatric patients had >5 times the mean total monthly visits for ILI (n = 5036) from July–October 2009, compared with the 8 adult/pediatric (n = 739) and 3 adult facilities (n = 250) combined.

All 26 hospital ED managers completed the Web-based survey (Table 1). Most facilities were community medical centers (n = 21), followed by academic teaching hospitals (n = 4) and a Veterans Affairs (VA) Hospital. Seventeen facilities (65%) primarily cared for both pediatric and adult patients, 3 only for pediatric patients, and 6 for only adult patients.

A majority (n = 15 or 58%) perceived increases in patient visits from July–October 2009, compared with the same period during the 2008 and when compared with last years influenza season (December 2008–March 2009 [n = 17; 65%]); this was especially the case in EDs seeing all or some pediatric patients (n = 3; 100%) (Figure 2). During this time, ED managers reported increases or substantial increases in lengths of stay (n = 15), number of patients leaving without being seen by a provider (n = 14), and the number of patients waiting to be seen by a provider (n = 18), especially the 3 pediatric facilities that all reported an increase or substantial increase in patients waiting to be seen by a provider (Figure 2). Although half of the respondents did not know their National Emergency Department Overcrowding Scale (NEDOCS) average from July–October 2009; 6 reported "overcrowding," 1 reported "severe overcrowding," and 2 pediatric EDs reported "dangerously overcrowded" (Table 2). Many also reported various space limitations including an insufficient number of patient treatment rooms (65%), total waiting room space (54%), space to designate a separate waiting room apart from those without ILI symptoms (58%) (Table 2), or space in urgent care/fast track (40%).

Five of 26 hospitals activated their Emergency Operations Center (EOC), including 2 of 3 pediatric EDs. All but 2 Eds reported having a pandemic influenza plan in place, with a third drafting their plan in 2009 (Table 1). Of these 24, close to half had not conducted tabletop or operational exercises with their plan. Fifteen EDs implemented the plan at some point during July–October 2009, and all but 2 indicated that the plan improved capacity to respond to patient surge. A majority of plans ($n = 20$) included maintaining a cache of medical equipment, such as gowns, gloves, N95 respirators, surgical masks, ventilators, portable beds, face shields, and influenza antiviral drugs. Fewer plans included tents, supplies to split waiting rooms, and HEPA air filtration systems. All EDs reported sufficient supplies of surgical masks, and most had a sufficient number of N95 respirators (88%), NP/OP swabs (92%), viral transport medium (91%), and antivirals (74%). Two of the pediatric EDs had in-sufficient supplies of N95 respirators and 1 reported antiviral shortages during the surge period.

Most ($n = 20$) had designated ≥1 alternative treatment sites, including outpatient clinics, other sections of the hospital, schools, community centers, or a preequipped mobile trailer (Table 1). Eight EDs reported using an alternative care site during the last 3 months (July–October 2009); 5 used an out-patient clinic, and 3 used other sections of the hospital. All 3 pediatric EDs reported insufficient waiting room space despite the use of alternative care sites. When compared with other EDs, those caring only for pediatric patients reported greater use of alternative treatment sites (17% vs 100%; $P = .01$). Over half of the EDs revised their triage protocols in the last 3 months from the time of the interview (Table 2). Changes included providing surgical masks at the ED entrance ($n = 11$) and at triage ($n = 12$) for patients, an ILI case definition screen for possible influenza (fever [temperature >100.0°F] >37.8 C plus cough and/or sore throat; n = 11), separate waiting rooms for patients with possible influenza ($n = 9$), and, less commonly, the use of mid-level providers, preapproved testing and treatment protocols, and triage of low-acuity patients to fast track or urgent care. Two EDs referred patients to primary care clinics. Of those with revised triage, 9 (64%) reported improved capacity to respond to patient surge from July through October 2009.

Sixteen (62%) maintained a roster of reserve staff as part of their pandemic influenza plan, with 15 calling in extra staff during July–October 2009 due to increased patient volumes alone and/or staff calling out sick. All but 1 of the 6 facilities with ill staff reported that <5% of their total staff called out sick and all reported that the majority of workers calling out sick had ILI. Sources of information on pH1N1 used by ED's included CDC ($n = 26$), their hospital's infection control practitioner ($n = 26$), the Georgia Hospital Association ($n = 17$), the hospital administrator ($n = 12$), and work colleagues ($n = 11$) (Table 2).

DISCUSSION

Metro-Atlanta was one of the first US regions affected by a fall wave of 2009 pH1N1-associated illness. Syndromic ED surveillance data supported the reported perceptions of surge by ED managers of increased health-seeking for ILI during July–October 2009, especially among pediatric facilities. All pediatric EDs reported increased numbers of visits, lengths of stays per visit, numbers leaving the ED without being seen, and ED waiting time.

Many of the facilities had current pandemic influenza plans and implemented revised triage criteria, alternative care sites, and emergency supply caches. Despite implemented influenza plans, the increased demand for ED care outstripped space and supplies. Two of the pediatric EDs had insufficient supplies of N95 respirators, and 1 reported antiviral shortages during the surge period, whereas all 3 reported insufficient waiting room space despite the use of alternative care sites. Two facilities had not created, and nearly half had not implemented, and/or drilled their pandemic influenza plans.

As in other natural, terrorism, or infectious disasters, reviewing and drilling plans are essential to their success [12, 13]. One facility commented, "We should have had a plan in place sooner and drilled that plan," while another reported that their "surge capacity drill allowed [them] to see areas of opportunities." A number of facilities reported serious structural limitations, including insufficient waiting room space or the ability to create a separate waiting room for those with possible influenza, further evidence that pandemic influenza plans must include on- or off-site alternative care sites and thresholds for their use. In Houston, Texas, the use of a covered parking lot staffed by a mobile pediatric emergency response team helped reduce emergency department surge [14]. Other researchers have advocated for using recently closed hospitals to accept medically stable patients [15]. When surge rapidly increases, hospitals may need to create capacity by cancelling elective surgeries [16] and admissions [17], discharging low-risk hospitalized patients [18], clearing the ED of ambulatory patients [19], boarding patients on inpatient floors [20], and converting the existing empty spaces (hallways, lobbies, and conference rooms) into spaces for beds [21].

Beyond structural constraints, a majority of facilities faced multiple staffing challenges. Strategies that have been used in other disasters include hiring additional staff to handle the surge in patients and covering missed work shifts of staff with ILI. Additional resources to increase flexibility for workers include, on-site day care for employee children [16] and emergency credentialing of volunteer health care professionals [22].

The results of this evaluation were limited by several factors. The syndromic surveillance data came from 14 of the 26 hospitals included in the ED manager survey. However, the 14 reporting hospitals account for nearly three-quarters of all ED visits in metro Atlanta. The retrospective nature of the Web-based survey, asking respondents about the last 3 months, permits recall bias. Information was only collected from the ED manager, and therefore may not represent the views of other ED personnel. The Hospital Emergency Management Coordinator, who leads disaster preparedness activities, is often different than the ED manager. Newer ED managers may not be aware of pandemic influenza plans developed or exercised prior to their involvement as the ED manager. Finally, ED managers' responses were not validated with objective hospital-based data, such as the number of patients who left without being seen by a provider and patient lengths of stay.

Hospitals must ensure they the have current pandemic plans and conduct drills in order to ensure preparedness for natural and man-made disasters, as well as future influenza pandemics. These plans should be detailed and describe the physical space, personnel, supplies required, and the criteria for initiating progressively advanced measures based on varying levels of surge. Although the fall 2009 surge in low-acuity ED visits in metro Atlanta proved challenging, increased disease severity requiring higher rates of patient hospital admissions and ICU stays could incapacitate EDs without appropriate plans in place.

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References

1. Kazzi AA, Langdorf MI, Handly N, White K, Ellis K. Earthquake epidemiology: The 1994 Los Angeles Earthquake emergency department experience at a community hospital. Prehosp Disaster Med. 2000; 15:12–19. [PubMed: 11066838]
2. Chu D, Chen RC, Ku CY, Chou P. The impact of SARS on hospital performance. BMC Health Serv Res. 2008; 8:228. [PubMed: 18990210]
3. McCarthy ML, Aronsky D, Kelen GD. The measurement of daily surge and its relevance to disaster preparedness. Acad Emerg Med. 2006; 13:1138–1141. [PubMed: 17032946]
4. American College of Emergency Medicine Practice Resources. [Accessed on 13 October 2009] Available at: http://www.acep.org/practres.aspx?id=29506
5. McManus J, Huebner K, Scheulen J. The science of surge: Detection and situational awareness. Acad Emerg Med. 2006; 13:1179–1182. [PubMed: 16968687]
6. Bonnett CJ, Peery BN, Cantrill SV, et al. Surge capacity: A proposed conceptual framework. Am J Emerg Med. 2007; 25:297–306. [PubMed: 17349904]
7. Centers for Disease Control and Prevention. Swine influenza A (H1N1) infection in two children–Southern California, March–April 2009. MMWR Morb Mortal Wkly Rep. 2009; 58:400–402. [PubMed: 19390508]
8. Dawood FS, Jain S, Finelli L, Shaw MW, et al. Emergence of a novel swine-origin influenza A (H1N1) virus in humans. N Engl J Med. 2009; 360:2605–2615. [PubMed: 19423869]
9. Centers for Disease Control and Prevention. Update: Influenza activity–United States, April–August 2009. MMWR Morb Mortal Wkly Rep. 2009; 58:1–4. [PubMed: 19145219]
10. Centers for Disease Control and Prevention. Update: Influenza activity–United States, August 30–October 31, 2009. MMWR Morb Mortal Wkly Rep. 2009; 58:1236–1241. [PubMed: 19910911]
11. Glaser CA, Gilliam S, Thompson WW, et al. Medical care capacity for influenza outbreaks, Los Angeles. Emerg Infect Dis. 2002; 8:569–574. [PubMed: 12023911]
12. Noji EK. Disaster epidemiology. Emerg Med Clin North Am. 1996; 14:289–300. [PubMed: 8635409]
13. Waeckerle JF. Disaster planning and response. N Engl J Med. 1991; 21(324):815–821.
14. Cruz AT, Patel B, Distefano MC, et al. Outside the box and into thick air: Implementation of an exterior mobile pediatric emergency response team for North American H1N1 (Swine) influenza virus in Houston, Texas. Ann Emerg Med. 2010; 55:23–31. [PubMed: 19837479]
15. Zane RD, Biddinger P, Ide L, Phillips S, et al. Use of "shuttered" hospitals to expand surge capacity. Prehosp Disaster Med. 2008; 23:121–127. [PubMed: 18557291]
16. Kaji AH, Lewis RJ. Hospital disaster preparedness in Los Angeles County. Acad Emerg Med. 2006; 13:1198–1203. [PubMed: 16885400]
17. Stratton SJ, Tyler RD. Characteristics of medical surge capacity demand for sudden-impact disasters. Acad Emerg Med. 2006; 11:1193–1197.
18. Kelen GD, McCarthy ML, Kraus CK, et al. Creation of surge capacity by early discharge of hospitalized patients at low risk for untoward events. Disaster Med Public Health Prep. 2009; 3:S10–S16. [PubMed: 19349868]

19. Nager AL, Khanna K. Emergency department surge: Models and practical implications. J Trauma. 2009; 67:S96–S99. [PubMed: 19667863]

20. McConnell KJ, Richards CF, Daya M, Bernell SL, Weathers CC, Lowe RA. Effect of increased ICU capacity on emergency department length of stay and ambulance diversion. Ann Emerg Med. 2005; 45:471–478. [PubMed: 15855939]

21. Forster AJ, Stiell I, Wells G, Lee AJ, van Walraven C. The effect of hospital occupancy on emergency department length of stay and patient disposition. Acad Emerg Med. 2003; 10:127–133. [PubMed: 12574009]

22. Schultz CH, Stratton SJ. Improving hospital surge capacity: A new concept for emergency credentialing of volunteers. Ann Emerg Med. 2007; 5:602–609.

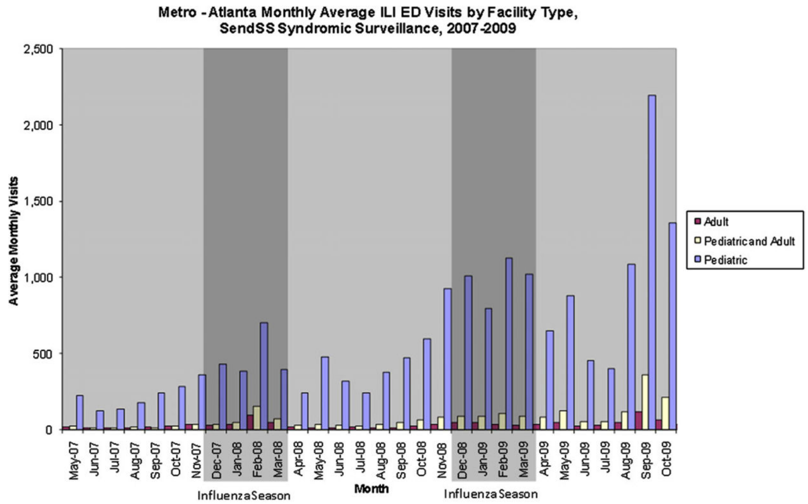

Figure 1.

Metro Atlanta mean monthly influenza-like illness (ILI) emergency department (ED) visits, 2007–2009. The dark shading represents the time period for seasonal influenza (December–March). Source: Georgia State's Electronic Notifiable Disease Surveillance System (SendSS), which collects data on all ED visits for 14 of the 26 hospital EDs in Health District 3 (metro-Atlanta area), May 2007–October 2009. Average number of visits based determined by number of reporting hospitals by reporting month. One of the 3 metro-Atlanta pediatric facilities does not report data to SendSS.

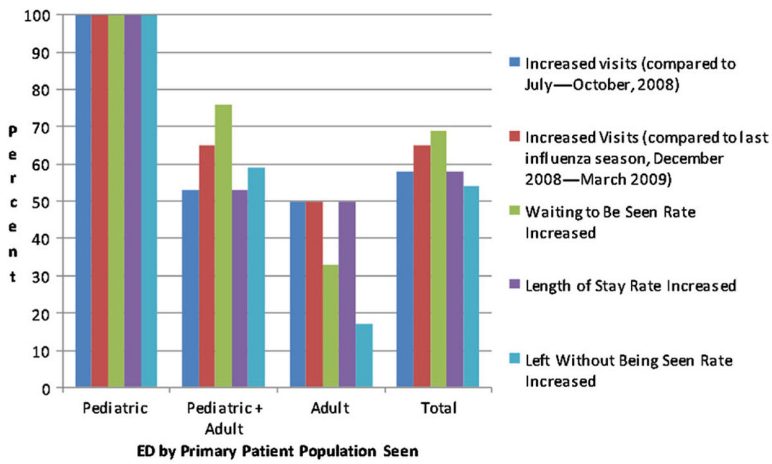

Figure 2.
Emergency department manager perceptions of surge, July–October 2009. (N=26).

Table 1

Characteristics of emergency departments (EDs) participating in ED Managers' Survey

	N = 26	
Average Daily Volume	n	(%)
<50 patients	0	-
50–150 patients	13	(50)
>150 patients	13	(50)
Hospital Type		
Community	21	(81)
Academic Teaching	4	(15)
Veterans Affairs	1	(4)
Primary Patient Population		
Pediatric	3	(12)
Pediatric + Adult	17	(65)
Adult	6	(23)
Pandemic Influenza Plan		
Developed a plan	24	(92)
Year of Development		
≤ 2008	14	(54)
2009	8	(31)
Unknown	4	(15)
Conducted Operational Exercises	12	(50)
Conducted Table-top Exercises	14	(58)
Implemented Plan for pH1N1 Influenza Surge	15	(63)
Plan Improved Capacity for Surge Response	15	(100)
Plan includes medical equipment cache	20	(83)
Surgical masks	20	(100)
N95 Respirators	20	(100)
Antivirals	16	(80)
Plan designates alternative care sites	20	(83)
Other section of your hospital	19	(95)
Outpatient Clinic	7	(35)
School	3	(15)

Table 2

Emergency Department Manager Responses to Web Survey of Actions Taken During the Fall Wave of 2009 Pandemic Influenza A (H1N1)[a]

	N = 26	
Staffing[a]	n	(%)
Maintained a roster of staff for patient Surges	16	(62)
Called in extra staff	15	(58)
Staff missed work because of possible influenza illness	6	(23)
Physical Space Limitations		
Insufficient number of patient treatment Rooms	17	(65)
Insufficient space to designate a separate waiting room	15	(58)
Insufficient waiting room space	14	(54)
Source of Information for pH1N1 Influenza		
Centers for Disease Control and Prevention (CDC)	26	(100)
Hospital Infection Control Practitioner	26	(100)
Hospital Administrator	12	(46)
Triage		
Revised triage	14	(54)
Included in the revised triage		
Surgical masks for patients with possible influenza at ED entrance	11	(79)
Surgical masks for patients with possible influenza at ED triage	12	(86)
An ILI[b] case definition to screen patients at Triage	11	(79)
Separate waiting rooms for patients with possible influenza at ED triage	9	(64)
Revised triage improved capacity to respond to patient surge	9	(64)
Overcrowding		
Average NEDOCS[c] *Score*		
Unknown	13	(50)
61–100 (Extremely busy but not overcrowded)	3	(12)
101–140 (Overcrowded)	6	(23)
141–180 (Severely overcrowded	1	(4)
181–200 (Dangerously overcrowded)	2	(8)

[a]All responses are in reference to July–October 2009 unless otherwise specified.

[b]Fever (temperature, >37.8°C) plus cough and/or sore throat.

[c]National Emergency Department Overcrowding Scale from the following formula:

−20 + 85.8 (Total Patients/ED Beds) + 600(Admits/Hospital Beds) + 13.4(Ventilators) + .93 (Longest Admit) + 5.64 (Last Bed Time).