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Brief Report

Airborne pathogen isolation capability in emergency departments of US children's hospitals

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The requirement for negative pressure isolation procedures has been an accepted component of pediatric care to protect patients and staff from highly infectious respiratory agents. Surveys regarding airborne isolation were distributed to 43 pediatric emergency departments at US children's hospitals with 26 responses. There was a median of 5 airborne isolation rooms, a median of 4 of those with negative pressure, and 61% without an ante-room. Capacity to manage pediatric patients infected with a highly pathogenic airborne-transmitted organism during an epidemic is limited.

The requirement for negative pressure isolation procedures has been an accepted component of pediatric care to protect patients and staff from highly infectious respiratory agents. Traditionally, this list has included varicella, tuberculosis, measles, smallpox, and plague.[1] Concerns abound that bioterrorist attacks might lead to widespread outbreaks of new engineered agents that can be spread by respiratory mechanisms.[2] Additionally, the threat of introducing emerging infectious diseases into the hospital system has reinforced that negative pressure isolation rooms are a valuable resource for hospitals.

Emergency departments (EDs) are the gateway to the hospital environment and appropriate cloistering of patients as early as possible is desired. In many cases, isolation is constrained by the availability of negative pressure isolation rooms. This limitation is exacerbated by the fact that a large percentage of pediatric ED visits are related to the evaluation, diagnosis, and management of acute respiratory illnesses.[3] Currently, there are limited guidelines to direct administrators and contractors regarding the standards for optimal protection of patients and staff in ED settings.

We conducted a survey of free-standing US children's hospitals to ascertain their existing capability for airborne isolation.

METHODS

A 10-question nonanonymous survey was developed by us and distributed by the Children's Hospital Association during fall and winter 2012-2013. Questions focused on specific airborne isolation capacity and perceptions of adequacy during routine management of endemic respiratory infections. Hospitals that received the survey were 43 primarily free-standing children's hospitals. SurveyMonkey (www.SurveyMonkey.com) was utilized and some hospitals not responding were directly contacted and interviewed by telephone. The University of Arkansas for Medical Sciences Institutional Review Board waived the consent requirement for this survey.

RESULTS

Responses were received from 26 of 43 (60%) hospital campuses representing 19 states. The median ED bed count was 38 (Table 1). Nine of 26 hospitals (35%) reported having a separate waiting area for those with suspected respiratory infections. All hospitals reported at least 1 airborne isolation room in the ED with the median number being 5 (12.7%) of total ED beds. Nearly all of the hospitals (25 out of 26) had airborne isolation rooms (median, 4 rooms) with negative pressure capabilities. A majority of respondents (17 of 25; 68%) reported that all airborne isolation rooms either vented directly outdoors or utilized high efficiency particulate air filters for vented air, but 3 respondents were unsure of what technology was used and 1 did not respond. The number of ante-rooms attached to an airborne isolation room ranged from 0-4, with 61% of facilities reporting 0 ante-rooms. Twenty-one of 26 respondents (81%) reported a positive level of confidence that the number of isolation beds was adequate for their needs on a routine basis. Finally, hospitals reported an average of 7 years since the ED underwent its last major renovation.

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Table 1
Results from a survey of free-standing children's hospitals regarding airborne pathogen isolation capability in emergency departments (N = 26)

Question	Response
Geographic region where facility was located?	Midwest 10 (38) Northeast 3 (12) South 10 (38) West 3 (12)
Do you have a waiting area for patients with apparent infectious respiratory agents separate from the general waiting area?	Yes 9 (35) No 17 (65)
During usual nonpandemic conditions, do you feel confident that you have adequate capacity for management of communicable respiratory diseases requiring airborne isolation in your emergency room?	Very confident 12 (46) Pretty confident 9 (35) Marginally confident 4 (15) Not confident at all 1 (4)
What is your current emergency room bed number?	39.2, 38, 15-80
How many rooms do you have in the emergency room that you consider airborne isolation rooms?	7.5, 5, 1-55
How many of your airborne isolation rooms have an ante-room?	0.7, 0, 0-4
How many of your airborne isolation rooms have negative pressure capability?	4.5, 4, 0-18
How many of your airborne isolation rooms vent directly outdoors or have high-efficiency particulate air filters for vented air?	7.3, 4.5, 1-55
Approximately what year was your last major emergency room renovation, or it not renovated, when was it built?	7, 4.5, 0-28*

NOTE. Values are presented an n (%) or mean, median, range.
*Calculated from date surveys were received.

DISCUSSION

The need for negative pressure isolation has been present for years as a practice within the infectious diseases community. The 2012 Red Book of the American Academy of Pediatrics lists as part of the requirement for airborne precautions the use of "special ventilation, including 6 to 12 air changes per hour, air flow direction from surrounding area to the room, and room air exhausted directly to the outside or re-circulated through a high-efficiency particulate air filter (HEPA)."[4] A review of 40 selected articles on this topic in 2007 concluded with recommendations for negatively pressured isolation rooms for patients with airborne-transmitted diseases because there was sufficient evidence to support an association between ventilation and air movement with disease transmission.[5]

A recent study from Australia determined the risk related to ventilation in different settings and showed the protective value of negative pressure isolation.[6] A Canadian review pointed out the value of prompt transfer of a patient with suspected severe acute respiratory syndrome into a negative isolation room and use of N-95 masks, which resulted in no secondary cases in 1 hospital. Conversely, an 18-hour wait in a general waiting room led to a city outbreak of 300 cases, 77% of which were hospital-acquired. These authors argue that negative isolation (ie, airborne isolation) rooms should be a requirement for all hospital ED rooms.[7] Two studies examined existing ED capacity for this requirement. In the United Kingdom, only 24% of hospitals had isolation rooms and of those only 61% had independent ventilation.[8] In a wider European study of EDs and medical admission departments from hospital referral centers for highly infectious diseases, 82.9% had isolation rooms, 50% of which had negative isolation, and 29.3% had high-efficiency particulate air filters for exhausted air.[9]

The situation among pediatric EDs in the United States from our survey showed that nearly all responders had negative pressure isolation room capability with a median of 4 airborne isolation ED rooms. Although 81% of respondents believed their respiratory isolation capacities were adequate, it is uncertain how these facilities would contain pandemic respiratory disease. Another concern arises with 16 of 26 facilities reporting no ante-rooms in the ED. This deficiency was highlighted by the assessment of capability needed for Ebola virus disease suspects because current guidelines from the Centers for Disease Control and Prevention call for doffing space or ante-rooms.[10] This study has several limitations, including being a convenience sample. Also, data were collected in 2012, so it may not be reflective of current ED capabilities.

At this time, state regulations for hospital ED construction vary and are relatively quiet on the requirement for airborne isolation. It is important that infection prevention and control staff provide input and lobby for improvements during hospital construction activities or the retrofitting of rooms in EDs.

CONCLUSIONS

The physical plant in US pediatric EDs is currently limited and might not be adequate in a pandemic situation. Our results raise the question of whether children's hospitals should develop long-term plans to increase the number of negative pressure rooms to handle endemic or pandemic cases requiring negative pressure isolation. Although many hospitals have developed plans for management of large-scale outbreaks that utilize off site triage and management of milder cases of epidemic disease, consideration should also be given to the number of rooms needed in managing severe cases in the ED setting.

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