

Tackling emerging outbreaks of infectious diseases: Preparedness for H1N1 influenza in emergency department of a tertiary care institute of India

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Abstract

With the threat of the emerging and reemerging infections (especially viral), it is time to gear up our health care facilities to tackle this menace. This short observational study conducted in the Out Patient Department of Emergency Department (ED), Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh in the month of August to October 2009 was done to analyze the efforts of preparedness of a pioneer institute of India PGIMER, Chandigarh when threatened by epidemic of H1N1 influenza. The information on existing policy, planning and its implementation regarding H1N1 were obtained. Data pertaining to infrastructural facilities, overcrowding and patient flow in the ED of PGIMER with respect to tackling of infectious outbreaks especially H1N1 influenza was collected. The data was also taken from laboratory registers of biochemistry and hematology labs present within the ED. The hospital census data pertaining to ED was obtained and analyzed. It was observed that the planning regarding pandemic influenza was initiated in PGIMER in August 2009, two months after first case of H1N1 was detected in Chandigarh.

A multidisciplinary committee was constituted. Nodal officers were identified and channel of flow of information within the hospital and with the local health departments was established. A Standard Operating Procedure (SOP) was developed for managing H1N1 patients. PGIMER regularly updated its H1N1 plans in accordance with the guidelines issued by the Ministry of Health and Family Welfare (MOHFW). According to "hospital pandemic influenza planning checklist" by Centre of Disease Control, Atlanta, PGI fared well. Though the efforts were started late, but these were satisfactory. However, it was observed that ED had overcrowding, non-systematic patient flow, high patient load and high Average Length of Stay (ALS). The hospital ED was reasonably well prepared to tackle H1N1 situation except few lacunae at the policy and implementation level that needed to be addressed immediately.

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Introduction

The Post Graduate Institute of Medical Education and Research (PGIMER) was conceived in 1960 as an centre of excellence for medical care in India, which later gained the status of Institute of National Importance of India by act of parliament. According to the hospital statistical abstract 2008-09, PGIMER (a 1500 bedded hospital) catered for 1.4 million outpatients and 59000 inpatients out of which the Emergency Out Patient Department (OPD) Department (ED) itself attended to 38370 outpatients and 27157 inpatients per year.¹ Emergency OPD is the “front door” of hospital that provides initial treatment to patients for with illnesses and injuries.

The present era of viral pandemics have been a cause of concern for ED administrators. This concern has been receiving repeated attention by medical apex institutions including PGIMER. This was reflected by the steps taken during the plague² and Severe Acute Respiratory Syndrome (SARS)³ outbreak. During plague outbreak, the initial diagnosis was missed and the patients were not isolated till diagnosis was made. This led to transmission of infection to a visitor of other patient, who later died. The arrangement was improvised during SARS outbreak, where makeshift modifications were done in the ED of PGIMER by establishing a control room at the reception for initial screening of cases, following a World Health Organization (WHO) protocol for management, and shifting the suspects directly to isolation room without infecting others unlike plague outbreak.^{2,3}

India's first confirmed case of H1N1 was reported on 16th May 2009. It took hardly a couple of months for this disease to hold grip in the country. Till 31th December 2009, a total of 25,912 cases and 956 deaths were reported from India (1,439,415 officially confirmed cases and 11,837 deaths world over). The first case of H1N1 was reported from Chandigarh on June 22nd 2009 in a 19 year old student who returned from United States. Till 31st December 2009, a total of 257 confirmed cases and 8 deaths were reported

from Chandigarh.⁴ With the occurrence of large number of cases and deaths due to H1N1, the need of preparedness of ED has again been accentuated. After the international pandemic alert was sounded by WHO in response to the H1N1 pandemic, PGIMER executed its plan to tackle the situation. The present study was conducted with an objective to evaluate the preparedness of PGIMER in response to H1N1 outbreak of 2009.

Material and methods

This short term observational study was conducted at PGIMER in the month of August to October 2009. The consent for undertaking the study was obtained from the Deputy Medical Superintendent (DMS) of PGIMER. The information on existing policy, planning and it's implementation regarding H1N1 was obtained from record review done and discussion with the DMS and Senior Medical Officer (SMO), Emergency. An observation checklist was used to assess data pertaining to infrastructural in-adequacies, patient screening system, infection control measures, factors leading to overcrowding, patient flow system and Information, Education and Communication (IEC) display in the ED of PGIMER with respect to tackling of infectious outbreaks especially H1N1 influenza. The total number of people present in ED were counted for six continuous days (1st - 6th Aug 2009 once in each 8 hour shift to assess the crowd in the ED with respect to the time distribution. Laboratory registers of biochemistry and hematology labs were also scrutinized from 1st to 6th August 2009 to assess the load in the laboratory of ED which was situated inside the ED campus. The hospital census data during the study period pertaining to ED was obtained to assess the patient load and analyzed. The ED indices like Average Length of Stay (ALS), Bed Occupancy Rate (BOR), Bed Turn Over Rate (BTOR) in the past 15 days was collected to assess the load of patients kept on observation in the premises of the ED. Annual hospital statistics data of the financial year 2008-09 was taken from the medical record section. The status of preparedness and response of PGIMER with regards to H1N1 influenza was duly filled in the

“hospital pandemic influenza planning” checklist by Centre for Disease Control (CDC). In addition, a quick telephonic survey of hospital administrators of 50 public and private hospitals of North India was done to access information about location of chemist shop, laboratories and other facilities within their emergency department. Statistical analysis was done using Epi-info software.

Results

The ED of PGIMER has three entrances manned by security guards. These opened into a spacious, well lit lobby. There were separate emergency wards for medicine and surgery. Till 1980's, ED contained 40 beds, which had now been expanded to 110. Sometimes additional trolleys were put in corridors to accommodate as many as 200 patients in ED. There was a registration area, reception counter, radiology room, attendant's waiting hall, laboratories, chemist shop, blood bank, common toilets, SMO's room and two halls for medicine and surgery OPD (Figure 1). There was no isolation facility or negative pressure isolation room within the ED to examine the infectious cases. However, there was an isolation room outside the ED, where the patient and their attendants generally reached while passing with-in the emergency.

There was a central air-conditioning system with different airflow units in ED. The overall signage system was not proper to guide the patients and their relatives. Parking space for the vehicles of patients or the staff who came to ED was inadequate. A Deputy Medical Superintendent (DMS) assisted by five Senior Medical Officers (SMO) look after the ED services. At any given time, there are at least three consultants, four senior resident doctors, six junior resident doctors, four nursing staff and two support staff who managed the patients in ED.

As per “hospital pandemic influenza planning checklist” by Centre of Disease Control (CDC), Atlanta, there was no set institutional mechanism in month of May 2009 for tackling H1N1 outbreak. However, the institute fared well in its preparedness for H1N1 in the month of August when the study was conducted.

Initially, no guidelines for tackling ‘pandemic’ situation were available in PGIMER. No simulation exercise

was done for H1N1 management. But after regular reporting of the cases in Chandigarh, the Chandigarh administration ordered the medical institutions (including PGIMER) to take remedial measures. The increased number of cases actually acted as a trigger for Chandigarh Administration initiate activities pertaining to H1N1. However, the peak of H1N1 cases were observed in month of December 2009 in Chandigarh. At PGIMER, 106 microbiologically positive cases (out of a total of 239) and 38 deaths were observed in month of December 2009. In August 2009, two months after the first case detection, the planning regarding pandemic influenza was initiated. A multidisciplinary committee was constituted by PGIMER to specifically address H1N1 preparedness. Senior doctors in various departments of the hospital were designated as nodal officers. Channel of flow of information within the hospital and with the local health departments was established. The H1N1 guidelines were updated regularly in accordance with the guidelines issued by the Ministry of Health and Family Welfare (MOHFW), Government of India after making few institution specific adjustments. Regular meetings were held under the chairmanship of Director PGIMER to monitor the activities (Table I).

A Standard Operating Procedure (SOP) for patient screening system (viz. triage, treatment and admission protocol of patients) was developed by School of Public Health, PGIMER, Chandigarh (Figure 2). A H1N1 screening area was established on 11th August, 2009 just outside the ED. It was a temporary enclosure of 10 by 18 feet (Figure 1). This screening area was initially manned by Senior Resident, Community Medicine, School of Public Health (SPH). Later it was managed by the department of Internal Medicine. The cases were defined according to the guidelines by the Ministry of Health and Family Welfare, Government of India. The cases that required isolation were transferred to Communicable Disease ward. All the patients coming to the ED had to pass through the level-1 screening (with the presence of security guards). The guards were told to direct all the patients who gave history of cough/ cold/ fever/ breathlessness/ respiratory difficulty or traveling outside the country to the screening area. At level-2 screening, the concerned physician stationed at screening area examined the patients. The suspected patients and their attendants were given

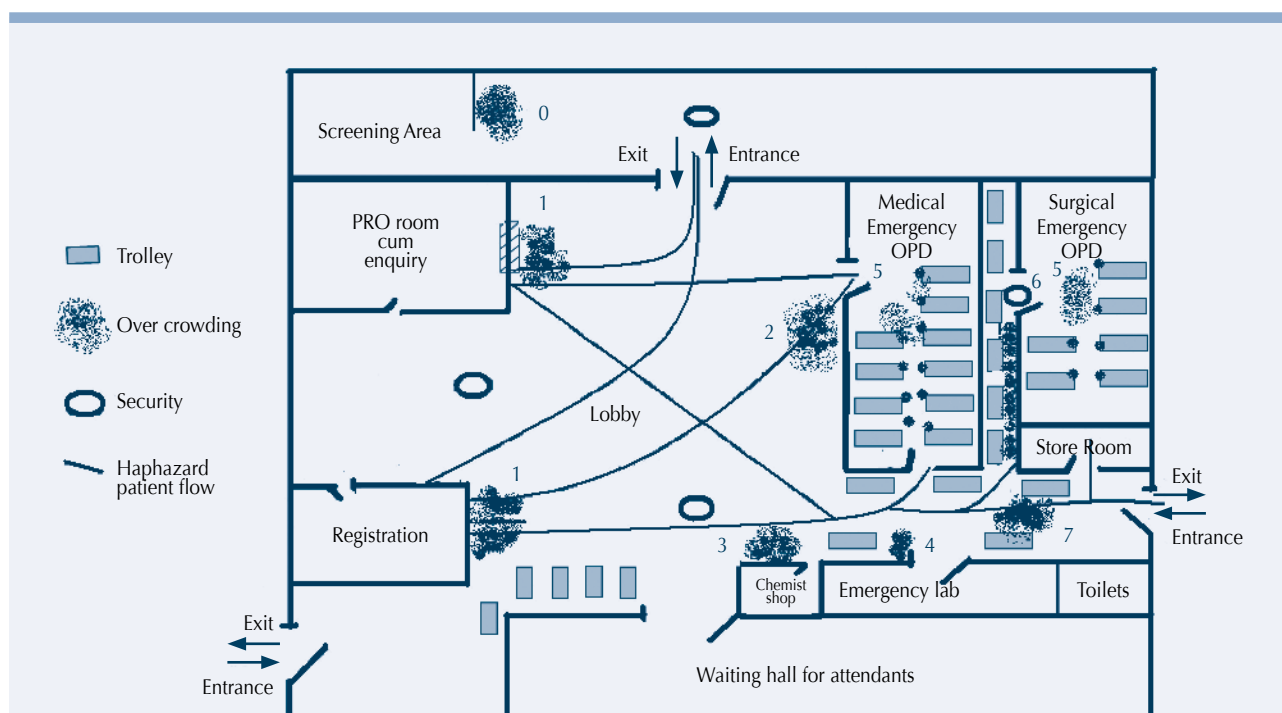
triple layer face masks and those needing admission were guided to the Communicable Disease (CD) ward. The staff in ED used triple layer face mask or N-95 mask as recommended by WHO. SPH was assigned to coordinate surveillance, line listing of patients, spot mapping, and descriptive analysis of cases. SPH also assisted in development of IEC material pertaining to H1N1 for display in hospitals, do contact tracing of the cases at their place of residence and compiled latest guidelines issued by Ministry of Health, Government of India. Issues related to surge capacity during a pandemic were also addressed. Four beds in CD ward and tetanus ward were committed for H1N1 patients. Later, two other screening areas (new OPD and Advance Pediatrics Centre) were made functional in PGIMER hospital campus.

PGIMER has an infection control committee, which institutionalized the infection control plan for H1N1 that guided the hospital staff to follow the standard precautions of infection control. The department of Hospital Administration ensured smooth supply of Personal Protective Measures (PPE) and medicines in ED right from the beginning, which continued un-interrupted throughout the outbreak situation. The occupational health issue was also addressed

by the department by various means like training of staff in prevention and control of infectious diseases especially H1N1, uninterrupted supply of oseltamivir for managing H1N1, priority administration of H1N1 influenza vaccine etc.

A total of 623 presumptive cases of H1N1 were detected by screening system at PGIMER in 2009 using guidelines issued by the Ministry of Health and Family Welfare, Government of India based on WHO criteria. Out of them 239 (38.3%) were confirmed microbiologically. Around 10% (n=23) of total confirmed cases were staff of PGIMER, mostly (80%) nursing personnel, who are supposed to be in closest proximity of patients. However, there was no staff shortage on account of sick leave or otherwise, and appropriate contingency plan for tackling staff shortage was present and executed as per CDC "hospital pandemic influenza planning checklist".

A major problem faced by the ED of PGIMER was overcrowding (Figure 1) that was not addressed adequately during the preparedness plan for H1N1. The scenario was only slightly better than the routine scenario of ED. Although, the number of patients attending ED was almost similar in the respective durations before the outbreak as compared to during



PRO- Public Relation Officer, ED- Emergency Department, OPD- Out Patient Department

Figure 1: Status of overcrowding in the ED of PGIMER

the outbreak (3184 patients in May, 2009 as compared to 3006 in May, 2008; 3237 patients in June, 2009 as compared to 3003 in June, 2008; 3456 patients in July, 2009 as compared to 3331 in July, 2008 and so on), but there was a huge rush of attendants and people enquiring about the H1N1 and also to get themselves investigated for H1N1. Despite stationing of additional number of security guards, the flow of patients and their attendants was not systematic and poorly controlled. As routinely observed, there was clustering around the reception area (Figure 1; area 1). Most of the time, more than two attendants accompanied a patient. This was against the norms of two attendants per patient. The corridors were overcrowded most of the times. This left little space for movement of patients and staff. It was observed that on an average, there were around 60-80 persons present in these corridors along with patient trolleys (Figure 1; area 5). The other factors that contributed to overcrowding was the presence of the laboratories within the premises of ED because of which substantial number of attendants entered the ED (Figure 1; area 4). Moreover, the collection and dissemination of reports were not systematic. It was seen that 66.5% (n=1811) samples to ED came from Biochemistry, 53.9% (n=1554) from Hematology and rest from the wards. Around 28.5% (n=1135) of the samples were brought before noon, 33.3% (n=1397) in the afternoon and 38.1% (n=1612) during evening and night. Reports were sent to respective units (till 10 pm) through the hospital attendants. Thereafter, the reports were kept in bundles outside emergency entrance in a shelf from where these could be taken by the attendants. There was no hospital staff to regulate the filling of reports at night hours. These bundles were crudely arranged without any logical system. The attendants reshuffled the bundle of reports every time, they searched the report of their patients, thus leading to crowding outside the laboratories. Another factor leading to overcrowding in the corridor was the presence of a chemist shop (Figure 1; area 3) within the ED premises, wherein, even the routine ward patients from outside emergency buy medicines. Commuters were seen to use ED corridors as a thoroughfare (Figure 1; area 7).

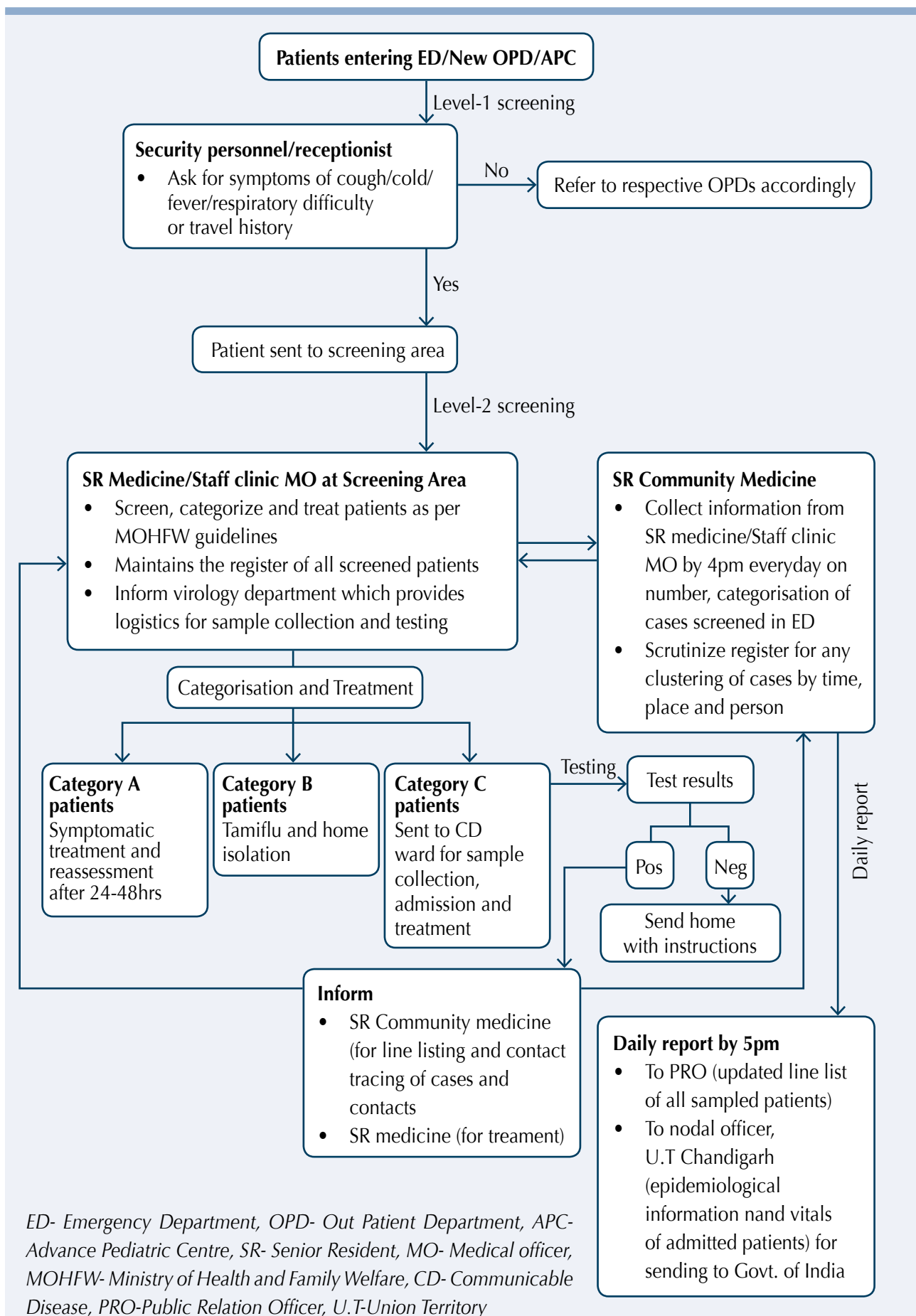
Daily census of the last three months reflected that a total of 9077 patients visited the ED. Out of these, the patient load was maximum (n= 3434; 37.8%)

in neurosurgery followed by internal medicine and gastroenterology (n= 1480; 16.7%). Average daily census showed a patient load of 98.7/day, which was more than two to three times the strength of observation beds. The Bed Turn Over Rate (BTOR) within ED was 153.96 and Average Length of Stay (ALS) of patients was 8.2 days with the minimum of 4 days and the maximum of 21 days. The Bed Occupancy Rate (BOR) of the ED was 94.9%.

The IEC material display related to sign and symptoms of H1N1 influenza, control and prevention measures etc., was minimal in ED. Few posters were visible depicting the precautionary measures to be adopted while interacting with a suspect patient of H1N1. Patients and attendants were frequently seen enquiring about the location of wards, doctors etc from the reception counter. There was no online access to information on recent outbreaks of infectious diseases. The journals related to infectious diseases like CD Alert, WHO weekly epidemiological reports were not being regularly subscribed by ED.

Discussion

Hospitals have a significant role in controlling epidemics of infectious diseases. But these can also become a potential site for spread of infection. This is exemplified by the deplorable incident in Taiwan, where 31 cases of Severe Acute Respiratory Syndrome (SARS) occurred after exposure to the index case in the ED.⁴ Various factors, in particular overcrowding affect the degree of risk of nosocomial spread of H1N1 in ED.⁵ Of late, ED preparedness has gained widespread attention of the health care planners. Studies have emphasized on the need of policy and guidelines, strategic vision and clarity for every ED about it's handling of H1N1 patients.⁶ Our study reflects the same. Most of the activities included in the H1N1 preparedness checklist were either complete or had been initiated by PGIMER barring the simulation exercises which were not required as the epidemic had already occurred. The ED preparedness at PGIMER regarding H1N1 included components like multidisciplinary planning, assigning primary and backup responsibility, coordinating and regularly updating the preparedness plan, setting a channel of flow of information, holding regular meetings and ensuring smooth supply of medicines and personal protective equipments.



ED- Emergency Department, OPD- Out Patient Department, APC- Advance Pediatric Centre, SR- Senior Resident, MO- Medical officer, MOHFW- Ministry of Health and Family Welfare, CD- Communicable Disease, PRO-Public Relation Officer, U.T-Union Territory

Figure 2: Patient Screening System at PGIMER Emergency OPD(ED)

It has been documented in studies that screening in emergency department maximizes operational efficiency.⁷ Studies have also shown that screening at the entrance of ED reduce overcrowding, improve patient flow and reduce transmission of infectious diseases including H1N1 influenza.⁷⁻⁸ The system developed for screening of H1N1 influenza patients at PGIMER was a commendable step. However, it should follow a strict protocol of screening and surveillance at all times 24 x 7, throughout the year. Patients arriving in ED should first be examined thoroughly to rule out the chance of cases of acute infectious disease mixing with the OPD crowd. A public health nurse and a medical social worker should be posted permanently in the ED. Only the screened patients should be allowed to enter the ED area along with one attendant. Such restriction of patient movement is crucial for ensuring infection control. However, it seems that there was minor spread of infection within the ED of PGIMER wherein, the health care staff, especially nurses, were most affected. However, no patient to patient spread was documented.

Overcrowding is a major obstacle to smooth functioning of the ED and contributes to a potential threat to the spread of infectious diseases.⁹⁻¹⁰ Overcrowding is determined by external pressure like high load of patients and limited infrastructure and the internal factors like mismanagement of space, improper patient flow.¹¹⁻¹³ It has been documented in various studies that overcrowding has many potential detrimental effects, including frustration for patients and ED personnel, lesser patient satisfaction, and greater risk of poor outcomes and spread of infection from communicable diseases including H1N1 influenza.^{9,10,14} Emergency department (ED) overcrowding may also affect the ability to provide good quality of care to the patients.¹⁵ Similar findings were observed in our study, where the overcrowding resulted in inefficient patient flow.

Our study has shown that besides the increased load of patients, overcrowding was a result of an extreme rush of attendants in laboratories present within the premises of ED. Other studies have also shown that the laboratory services are utilized mostly by non-emergency patients admitted in the hospital, leading not only to unnecessary load on the laboratory but also increasing the rush in emergency.¹² The present system

of attendants transporting the samples and collecting the reports also leads to unnecessary crowding within ED of PGIMER. Our observations pertaining to overcrowding resulting from infrastructures problems in the setting of the ED like having a chemist shop and lab within the same casualty area was endorsed by expert opinions of leading hospital administrators of 50 public and private hospitals of India. Less than one fifth of these hospitals have chemist shop within the ED and almost half have laboratory within the premises of ED. Almost all the private hospitals interviewed have these facilities outside the ED area. Most of the administrators having these facilities within the emergency complex were of the view that they play a major role in overcrowding within the premises of ED. They considered them as infrastructural inadequacies, which should be tackled at the hospital designing phase. It is also suggested that ward attendants should deposit the samples and collect reports for the proper management. Such simple reorganizations can lead to major improvement in the problem of overcrowding at ED. Some coding/ tagging system or computerized system needs to be devised to avoid confusion about the reports. The institute should develop a computerized patient information system wherein, the reports should automatically be entered against the patient file in computer by laboratory attendant, which can then be easily accessed by treating physician. This system will improve the efficiency of the system and prevent overcrowding and mismanagement at the report collecting counter.

Our study also underscores the need of development of appropriate signage in the ED, removing trolleys from the corridors and banning entry of commuters so as to reduce overcrowding. Appropriate use of waiting area would also reduce this problem. The trolley bay, canteen, chemist shop and toilet facilities for the attendants could be relocated outside the main premises of ED. Parking space for ambulance and personal vehicles of the attendants of the patients should also be earmarked. The casualty complex should have an isolation room in its premises, and a separate examination, resuscitation and triage cubicles to handle infectious cases. The same settings could not be found in the literature from India or other countries but the findings of a quick survey done by team of authors of the study revealed that similar settings was

Table 1. Status of Preparedness and Response for H1N1 Influenza of Post Graduate Institute of Medical Education and Research (PGIMER) as per CDC "Hospital Pandemic Influenza Planning Checklist"

Coding: 0-Not started, 1- In progress, 2- Completed

A. Structure for planning and decision making	May	August
Pandemic influenza incorporated into disaster planning and exercises for the hospital.	0	1
A multidisciplinary planning committee identified to specifically address pandemic influenza preparedness planning and preparedness testing	0	2
Primary and backup responsibility has been assigned for coordinating preparedness planning.	0	2
Points of contact for information on pandemic influenza planning resources identified within local health departments and the state hospital association.	0	2
Local, regional or state emergency preparedness groups identified.	0	2
Local or regional pandemic influenza planning groups contacted for information on coordinating the facility's plan with other pandemic influenza plans.	0	2
B. Development of a written pandemic influenza plan		
Relevant sections of the HHS Pandemic Influenza Plan and policy documents obtained and reviewed for incorporation in the plan.	0	1
Facility plan and other relevant materials available in Administration and Infection Control team.	0	2
The plan includes strategies for collaborating with local and regional planning and response groups and hospitals and other healthcare facilities.	0	2
The plan identifies the person(s) authorized to implement the plan and the organizational structure that will be used.	0	2
Responsibilities of key personnel and departments within the facility described in plan.	0	2
Personnel who will serve as back-up (e.g., B team) for key personnel roles identified.	0	1
A tabletop simulation exercise or other exercises developed to test the plan.	0	0
A full scale drill/exercise has been developed to test the plan.	0	0
The plan is updated regularly and includes current contact information.	0	2
C. Elements of an influenza pandemic plan.		
A plan for surveillance and detection of pandemic influenza in hospital patients and staff	0	2
A facility communication plan developed and is coordinated with the local health authority.	0	2
A plan to provide education and training for personnel and information for patients and visitors in place	0	1
A plan has been developed for triage (e.g., initial patient evaluation) and admission of patients during a pandemic.	0	2
A plan has been developed to address the needs of specific patient populations.	0	1
A plan has been developed for facility access during a pandemic.	0	1
A plan has been developed for facility security during a pandemic.	0	0
An infection control plan is in place for managing hospital patients with pandemic influenza.	0	2
An occupational health plan for addressing staff absences and other related occupational issues developed.	0	2
A vaccine and antiviral use plan has been developed	0	1
Issues related to surge capacity during a pandemic have been addressed and discussed with the local and/or State health department and other pandemic influenza planning partners.	0	2

present in almost all the public and private hospitals in Northern part of India. The similar problem of using laboratories and chemist shops from patients outside ED was present in the hospitals.

Average Length of stay (ALS) is a key measure of emergency department (ED) throughput and a marker of overcrowding. It has been observed that increased length of stay leads to overcrowding.¹⁶ As there is no policy for reducing the ALS of the patients in the ED, it needs to be developed. There should be sincere efforts from the individual departments to shift their patients to the wards as early as possible (within 24 hrs preferably). The high burden of patients on the PGIMER could be tackled by sharing the patient load with other major hospitals of Chandigarh viz. General Hospital and Government Medical College, which also needs to be suitably upgraded. There should also be a strict admission and discharge policy to regulate the patient turnover rate. In fact, it is suggested that an independent ED building needs to be developed to adjust the patient overload. It will be in line with the other development policies in the institute in recent past where gradually various departments have been shifted from main hospital to independent buildings (Advanced Pediatric centre, Eye centre, Advanced Cardiac centre, Oral health sciences and Trauma centre).

Various studies have documented that ED of those hospitals which have clear guidelines on personal protection for staff and for patient care have greater retention of employees within organization.¹⁷⁻¹⁸ PGIMER had clear cut guidelines for personal protection of staff in case of occurrence of any outbreak situation including H1N1 influenza. Although there were regular trainings for staff regarding infection control, hand washing, but the doctors posted in emergency were not regularly oriented about locally endemic diseases and impending outbreaks so that they can keep a watch for any suggestive symptoms. A draft contingency plan for avian influenza has been included by Government of India in the Integrated Disease Surveillance Programme (IDSP) training of medical officers, but it lacks the necessary focus for the ED.¹⁹ Global networks can be used to monitor and track infectious diseases outbreaks, which would help EDs to anticipate future problems.²⁰ Additionally,

a regular audit for the assessment of preparedness level of ED needs to be ensured and simulation exercise should be done at regular intervals. PGIMER should also ensure the component of preparedness of outbreaks in ED while framing a Health Promoting Hospital (HPH) policy to provide leadership to other hospitals of India.²¹

With regular pandemics of life threatening diseases emerging in the world such as SARS, Plague and H1N1 influenza in the recent past, the promptness and quality of emergency medical care has become an essential feature for emergency departments. A knee jerk response is not acceptable in this era of infectious disease outbreaks. The infectious disease preparedness should be perpetually maintained by all the institutions in the country. The lesson learnt from the study could be utilized to increase its throughput and possibly other EDs in the developing countries with similar settings.

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