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Original Article

Socioeconomic impact of the recent outbreak of H1N1

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ABSTRACT

Background & aim: Recent outbreak of H1N1 influenza leads to increased morbidity and mortality. High infection rate and virulence created panic among masses and huge health care burden. Socio-economic impact of H1N1 influenza has been underestimated. We describe socio-economic impact of H1N1 by taking hospitalization expenditure model.

Method: In a prospective observational study at tertiary care centre in Northern India hospitalization costs were collected from 1st January 2015 to 31st March 2015. Real time reverse transcriptase polymerase chain reaction (RT-PCR) testing on nasopharyngeal swabs was used to confirm diagnosis.

Result: Data of 209 patients were analyzed. Age of the patients ranged from 3 months to 85 years. The mean and median age of the patients was 41.5 and 45 years respectively. Female patients constituted 46% of all patients admitted. Hospital stay duration ranged from 1 day to 41 days. Minimum and maximum expenditure was 164 USD and 32548 USD respectively. Mean expenditure was 3326 USD. Mean room rent was 940 USD, investigation cost –457 USD, medicines cost – 808 USD, doctors' consultation- 468USD and miscellaneous cost of 653 USD. Mean expenditure in H1N1 ward was 17 times(1983 USD), whereas in isolated single room it was 22 times(2554 USD) and in ICU mean expenditure was 62 times(7172 USD) the monthly per capita income. Expenditure increased with increasing age ($P = 0.004$) with highest expenditure was seen in age group more than 60 years and lowest among age group less than 20 years. Apart from these direct effects, H1N1 influenza had huge indirect impact on the socio-economic framework in terms of absenteeism, decreased manpower causing economic slowdown, low tourism increased workload and anxiety among healthcare workers.

Conclusion: H1N1 influenza outbreak severely affected the socio-economic framework of the country. Isolation wards seem to be cost effective and expenditure has got direct linear association with age.

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1. Introduction

Recent outbreak of H1N1 in India which is a developing country has a huge impact on socio-economic to health related morbidity and mortality. It caused various problems with huge financial burden on individuals as well as insurance providers. Although morbidity and mortality data are available, there is still a dearth of enough facts and figures regarding impact on the economic front.

Influenza is a well known illness with a long history of pandemic dating back to 1918. It's known for its unique property of reassortment which makes it virulent and escapes humoral immunity. Triple reassortment of influenza virus containing genes from human swine and avian genome was identified in 1998. But the virus identified in 2009 was a novel virus of swine origin which leads to the pandemic.¹

The strain of H1N1 virus causing outbreak was confirmed By National Institute of Virology, Pune.² The virulent strain can affect young healthy adults besides patients with high risk factors thus causing panic among a large section of the population.³ Recent outbreak had a substantial health burden and huge implication ranging from closure of schools⁴ to low productivity and economic slowdown which was observed globally.⁵ Due to a lack of any model to assess its economic impact it's been least understood.

Previous pandemics made health care providers more alert. It was a notifiable disease and increase in surveillance was ensured. All suspected and confirmed cases were notified to the concerned authorities. Isolation wards in selected hospitals (public and private), approved diagnostic centers for H1N1 diagnosis by PCR and supply of drugs like oseltamivir were few steps taken to tackle this epidemic. For clinical practitioners H1N1 management guidelines were issued for uniformity in treatment.⁶

Still there is a gap in knowledge because of the lack of mortality estimates and its socio-economic impact

assessment in developing countries. There is a need to strengthen influenza surveillance worldwide to have a better understanding of diagnostic, therapeutic as well as preventive aspects of influenza outbreak.

2. Material and methods

2.1. Study setting and subjects

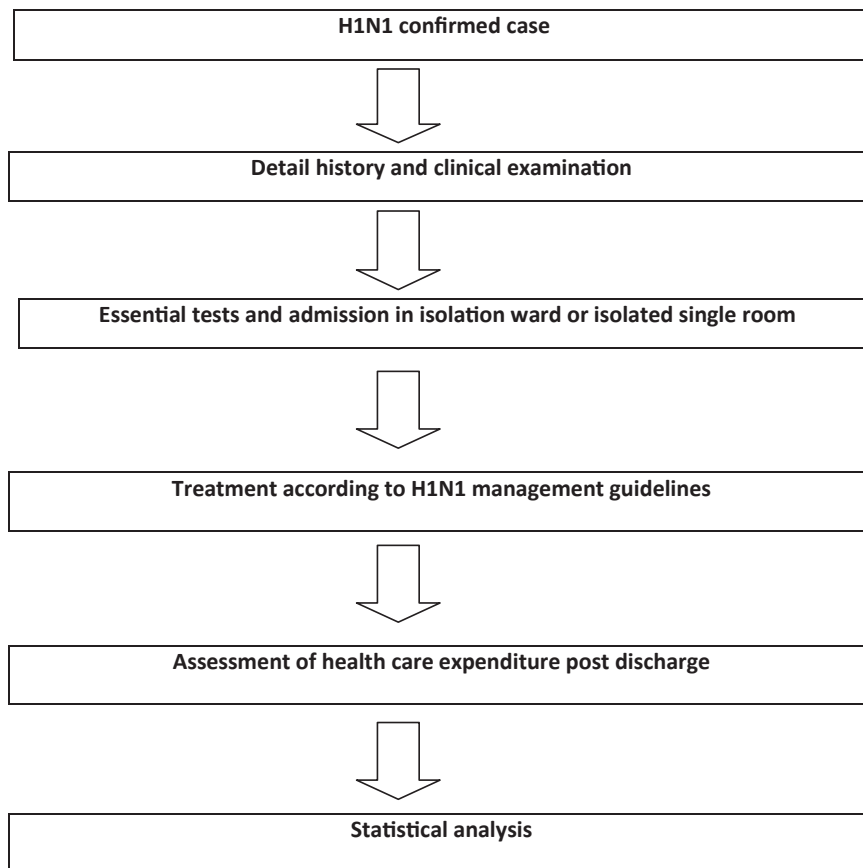
This was an observational study conducted in a 675 bed tertiary care center located at northern part of India from January 1st to march 31st 2015. All the patients included in the study were confirmed cases of H1N1 diagnosed by RT-PCR. Inclusion criteria were all confirmed cases of H1N1 influenza diagnosed by RT-PCR and in category 2b (Table 1) and above. Exclusion criteria were hospital employees and all those patients who were exempted from hospitalization expenses.

2.2. Study procedures

All the patients admitted were routinely monitored and essential tests were done (Flow Chart 1). Demographic, clinical, and initial laboratory data were collected from hospital database. The radiographic diagnostics and microbiological reports (i.e., blood & urine culture, bronchoalveolar lavage, and tracheal aspirates) if available were considered. Total hospital expenditure data was collected after discharge from billing section and was further segregated from expenses incurred from medicines, investigations, room rent, doctors' consultation and miscellaneous. Duration of hospital stay and duration of onset of illness till presentation to healthcare provider were also recorded. There was no diagnostic or therapeutic intervention done as part of the study.

Table 1 – Categorization of influenza a H1N1.

Categories	Clinical features	Antiviral treatment	RT-PCR test	Hospitalization
A	Mild fever plus cough/sore throat	Do not require	Not recommended	Home isolation
B1	Category-A + high grade fever and severe sore throat	May require	Not recommended	Home isolation Broad Spectrum antibiotics as per the Guideline for Community acquired pneumonia (CAP) may be prescribed
B2	Category-A, plus one or more of the following: Pregnant women Lung/heart/liver/kidney/neurological disease, blood disorders/diabetes/cancer/HIV-AIDS On long term steroids Children — mild illness but with predisposing risk factors Age 65 years+	Require	Not recommended	Home isolation Broad Spectrum antibiotics as per the Guideline for Community acquired pneumonia (CAP) may be prescribed
C	Category-A and B, plus one or more of the following: Breathlessness, chest pain, drowsiness, fall in blood pressure, haemoptysis, cyanosis Children with influenza like illness with red flag signs (somnia, high/persistent fever, inability to feed well, convulsions, dyspnoea/respiratory distress, etc) Worsening of underlying chronic conditions	Require	Recommended	Immediate Hospitalization and treatment

Algorithm of study**Flow Chart 1****2.3. Identification of the 2009 H1N1 virus**

H1N1 status was assessed by RT-PCR in all the patients using nasopharyngeal swabs. These samples were tested for 2009 H1N1 in a government accredited laboratory according to the Centers for Disease Control (CDC) RTPCR Protocol for the Detection and Characterization of Swine Influenza (version 2009).⁷

2.4. Hospital expenditure

All the hospitalization cost from the time of admission till discharge was carefully analyzed. Patients admitted were allowed to opt for H1N1 ward or single isolation room. Although the line of management remains the same, expenses were higher in single rooms which were being informed prior to admission. So data was analyzed separately for single and isolation ward patients.

Patients were treated with broad spectrum antibiotics as per the guidelines of community acquired pneumonia along with antiviral (oseltamivir 75–150 mg twice daily depending on severity and creatinine clearance as per guidelines) in admitted patients.⁸

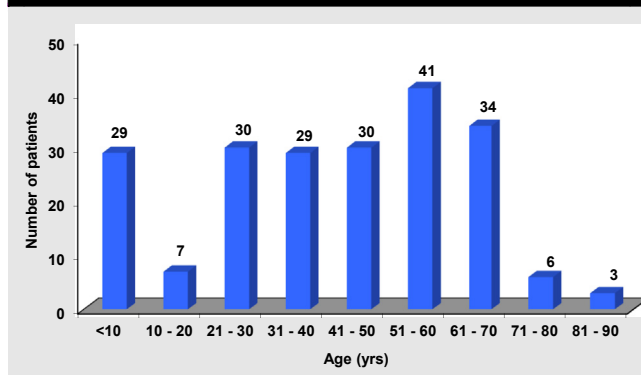
3. Statistical analysis

SPSS version 17.0 was used to analyze data. Results are reported as mean, standard deviation, frequency and percentage. Linear regression was used between expenditure and age. $P < 0.005$ was taken as significant.

4. Results**4.1. Demography**

This report describes 209 hospitalized patients with confirmed H1N1 swine flu infection from January 1, 2015 to March 31st, 2015. All the patients included in the study were confirmed cases from government authorized diagnostic centers.

Age of the patients ranged from 3months to 85 years. The mean and median age of the patients was 41.5 and 45 Years respectively. 54.3% of the patients were 40 years of age or older (Table 2). Female patients constituted 46% of all patients admitted. A total of 52.9% of the patients had one or more coexisting medical conditions. Hypertension and diabetes was found to have prevalence of 23 and 22.5% among admitted patients. Mortality observed was 10.5%.

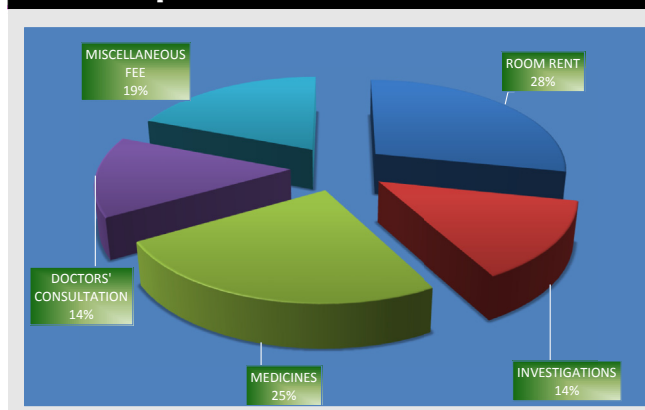
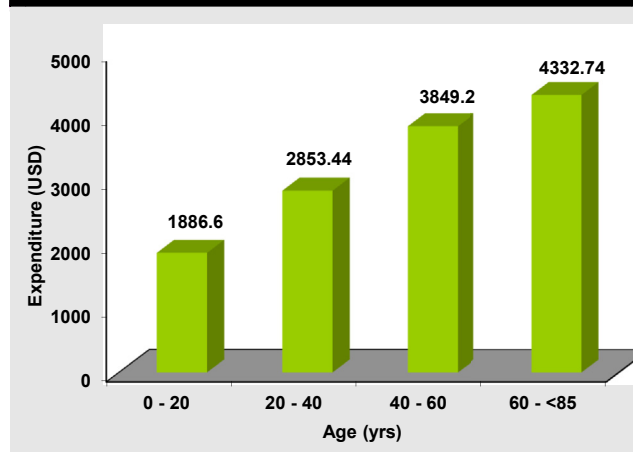
Table 2 – Age wise distribution of patients.

4.2. Duration of hospital stay

Hospital stay duration ranged from 1 day to 41 days. Mean and median duration of stay was 7.69 and 6 days. Patients who succumbed to H1N1 had longer duration of stay (mean – 10.48 days) as compared to the patients who were discharged in stable condition (mean – 7.35 days).

4.3. Hospitalization expenses

Minimum and maximum expenditure was 164 USD and 32,548 USD respectively. Mean expenditure was 3326 USD. Mean room rent was 940 USD, investigation cost – 457 USD, medicines cost – 808 USD, doctors' consultation – 468 USD and miscellaneous cost of 653 USD (Table 3). Expenditure varied significantly depending type of room (isolation ward or isolated single room) and for ICU admissions. Mean expenditure in isolation ward was 1983 USD, single isolated rooms – 2554 USD and ICU admission – 7172 USD. Expenditure was also assessed in age groups of 0 – <20, 20 – <40, 40 – <60, 60 – <85 and mean total average expenditure was 1886.6 USD, 2853.4 USD, 3849.2 USD, 4332.7 USD respectively (Table 4).

Table 3 – Expenditure distributions.**Table 4 – Age wise expenditure distribution.**

5. Discussion

Emerging infectious diseases, by definition, are relatively difficult to manage for physicians and are therefore poised to generate widespread infection and mortality prior to identification of the etiologic agent. Even drug or vaccines development and approval takes time. The delay in reaching the market leads to significantly high morbidity in the initial years of an epidemic. Direct economic effects of illness resulting from influenza include increased healthcare expenditures by patients and funders (e.g., governments, insurers), and increased workloads for healthcare workers. Indirect effects include a smaller labor supply due to deaths, and increased absenteeism from work by sick workers and by workers wishing to reduce the risk of contracting illness in the workplace, i.e., prophylactic absenteeism.⁹

H1N1 outbreak this year (Jan–March 2015) had a huge impact on morbidity, mortality and economic framework of our society. Due to greater morbidity and risk of acquiring infection, schools and offices attendance was affected.¹⁰ It created panic among masses and lead to economic slowdown. Various factors responsible for it were, for instance, decreased man power, decreased demand and supply and an overall state of chaos. Health care sector also witnessed significant loss of skilled man power due to various reasons including illness. This had put significant strain on the healthcare delivery system at a time when it could least afford it.¹¹

Emergence of this novel strain made everyone susceptible. It had a huge impact because it affected younger individuals. In our study mean age was 41.5 years and age ranged from 3 months to 85 years. Earning members are compelled to miss work due to the disease to provide care to other members of family causing financial loss.

In our study we studied the impact of H1N1 in the terms of mortality, loss of working days and its economic impact. Overall the mortality rate in our tertiary care center was 10.5% which was much higher than reported mortality data for India which is 5.94%.¹² Reason behind higher mortality can be attributed to the study centre being a tertiary care centre and patient selection of category 2b and higher.

For the management of H1N1 Indian guidelines direct to prevent and contain outbreak of Influenza A H1N1 virus, and all the individuals seeking consultations for flu like symptoms are screened at designated healthcare facilities or examined by a doctor and these are categorized depending on the severity of illness and presence of risk factors. They have been categorized in three groups A, B1, B2 and C (Table 1).

Hospitalization expenses due to H1N1 were significantly low for patients admitted in isolation ward as compared to isolated single rooms with no difference in outcomes of the treatment. Investigation expenses were the least among other sources of expenses during hospitalization.

India's monthly per capita income, the measure of standard of living, is likely to be at Rs 7378.17 (USD 118.68) this financial year.¹³ Mean expenditure in isolation ward was 17 times, whereas in isolated single room it was 22 times and in ICU mean expenditure was 62 times the monthly per capita income. Expenditure was significantly higher in isolated single room compared to H1N1 isolation ward ($P = 0.010$). Age wise distribution of expenditure showed linear increase with age ($P = 0.004$). This may be explained by increasing co morbidities, increased duration of hospital stay and greater risk of ICU admission seen with higher age groups.

Mean duration of hospital stay was 7.35 days. Duration ranged from 1 day to 41 days. Higher mean duration of stay was seen among the patients who couldn't survive (10.48 days). All the patients who were stable were followed up after five days of getting discharged. Apart from hospitalization duration there could be associated absenteeism during the convalescent period which couldn't be calculated.

To conclude there is no previous data from India to compare the socio-economic impact. It's the first report to give fair information regarding economic impact of h1n1 influenza. Economic activity will be more strongly affected by a pandemic with high infection rates rather than high virulence rates. The social effect of H1N1 could not be done objectively as absenteeism from work/office/school, decreased productivity and tourism cannot be measured as there are no models to assess it.

Conflicts of interest

The authors have none to declare.

REFERENCES

1. Dawood FS, et al. Emergence of a novel swine-origin influenza A (H1N1) virus in humans. *N Engl J Med*. 2009;360:2605–2615.
2. From National Institute of Virology (NIV), Pune. <http://pib.nic.in/newsite/printrelease.aspx?Relid=116939>.
3. Crum-Cianflone NF, Blair PJ, Faix D, et al. Clinical and epidemiologic characteristics of an outbreak of novel H1N1 (Swine Origin) influenza A virus among United States military beneficiaries. *Clin Infect Dis*. 2009;49:1801–1810. <http://dx.doi.org/10.1086/648508>.
4. WHO recants H1N1 advice on schools. <http://timesofindia.indiatimes.com/india/WHO-recants-H1N1-advice-on-schools/articleshow/5004007.cms>.
5. Annual Meetings 2009: H1N1 Update Press Briefing. <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTHEALTHNUTRITIONANDPOPULATION/0,contentMDK:22339733~menuPK:282554~pagePK:64020865~piPK:149114~theSitePK:282511,00.html>.
6. Clinical management Protocol and Infection Control Guidelines. <http://mohfw.nic.in/showfile.php?Lid=1170>.
7. Centers for Disease Control (CDC) RTPCR Protocol for the Detection and Characterization of Swine Influenza (version 2009). http://www.who.int/csr/resources/publications/swineflu/CDCrealtimeRTPCRprotocol_20090428.pdf.
8. WHO Guidelines for Pharmacological Management of Pandemic Influenza A(H1N1) 2009 and other Influenza Viruses (Revised February 2010). http://www.who.int/csr/resources/publications/swineflu/h1n1_guidelines_pharmaceutical_mngt.pdf.
9. Galante M, Garin O, Sicuri E, et al. Health services utilization, work absenteeism and costs of pandemic influenza a (H1N1) 2009 in Spain: a multicenter-longitudinal study. *PLoS ONE*. 2012;7:e31696. <http://dx.doi.org/10.1371/journal.pone.0031696>.
10. 7 kids contract H1N1, Karnataka school shut for a week. <http://timesofindia.indiatimes.com/india/7-kids-contract-H1N1-Karnataka-school-shut-for-a-week/articleshow/46449953.cms>.
11. Assessment of the 2009 Influenza A (H1N1) Pandemic on Selected Countries in the Southern Hemisphere. <http://www.flu.gov/pandemic/global/final.pdf>.
12. Swine flu claims 12 more lives, toll rises to 2,035. <http://nidm.gov.in/PDF/DU/2015/March/29-03-15.pdf>.
13. Advance Estimates of National Income, 2014–15 And Quarterly Estimates of Gross Domestic Product for the Third Quarter (Oct–Dec), 2014–15. <http://pib.nic.in/newsite/PrintRelease.aspx?relid=115294>.